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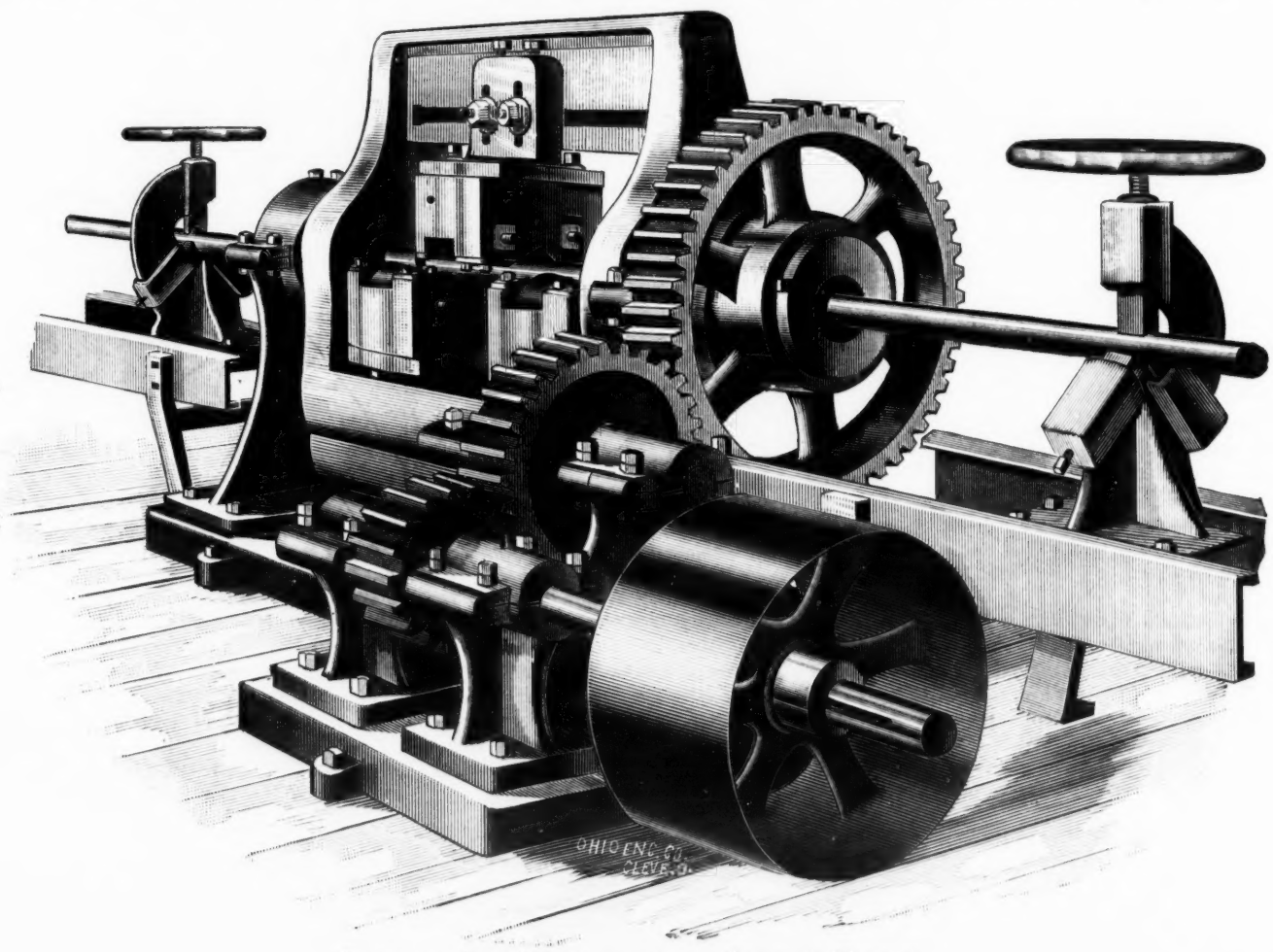
Shaft and Pipe Straightening and Finishing Machine.

The illustration represents a machine for straightening shafts and pipes. It is principally intended for use in rolling-mills and pipe works. But its usefulness extends further; it may be employed with advantage in any works in which large quantities of shafting are turned out; it can be profitably used by machinists who make a specialty of turning shafting.

The work done by this machine is superior to that which can be obtained by the old method of straightening with a press, and it is claimed that this machine not only straightens the shafts, but also puts on them a very fine finish, such as cannot be produced by the old process of filing and polishing with emery.

The machine is very simple in construction, and the principle of its action is so plainly shown in the illustration that a short description only is necessary. The shaft is passed between the rolls and is held by the vises. Chilled rolls are placed in housings, which in turn are attached to the large center piece. This center piece is provided with trunnions which work in the bearings shown at each of its sides, and revolves around the shaft. The housings which contain the chilled rolls can be set to any desired angle, thereby giving the shaft an automatic feed through the machine. The housings can readily be adjusted to suit any diameter of shaft, say from one to four and one-half inches. For pipes they are made in different sizes to suit any required diameter. The pipes and shafts are straightened cold, and it is claimed that the machine is capable of turning out from 20 to 30 tons of rough or finished shafting per day of ten hours.



SHAFT AND PIPE STRAIGHTENING AND FINISHING MACHINE.

These machines are manufactured by the Brightman Machine Co., Cleveland, Ohio.

A correspondent would like some one with experience to give him information about hardening blocks of steel five or six inches square, such as are used for drop forge dies. He does not always have good luck with such pieces. He heats with charcoal in a small forge, and it requires two and a half to three hours to heat. After the piece has been in the water about ten minutes it cracks. He wants to know the best practice with such pieces.

Practical Details of Bluing.

BY B. F. SPALDING.

STAINS — DEGREES OF TEMPERATURE — ASH BLUING — SAND PAN WORK — CHARCOAL BLUING — CLEANING — IRREGULAR FORMS — LIGHT — BLUING CAST AND MALLEABLE IRON — ARMORY PROCESS — MIXING MATERIALS — HEAT TEST — PERMANENCE OF COLOR — DANGER — PENETRABILITY OF STEEL — EFFECT OF COMPOSITION ON COLOR — SPARK INDICATIONS.

The brilliant blue, brought out by heat on a highly polished piece of steel, certainly presents a beautiful appearance, which pleases all who behold it. It may be produced by various processes, but in order to produce the best results it is necessary, in them all, that the surface shall be made thoroughly clean. If a piece of highly polished steel is simply touched with the uncovered hand, there will be an impression left upon it, which will show after it is blued, unless the imperceptable stain is removed before heat is applied. The blue color is due to a certain amount of oxidation corresponding with a definite degree of heat. The temperature, as is indicated by the colors which govern in drawing the temper of tools, is given in the table which follows. The names of tools to which the different tempers are applicable are not given, as in these later days that is a thing to be determined by experiment on the special steel in hand.

425° F.—Color starts pale yellow.	
450° F.—Straw.	500° F.—Brown.
475° F.—Orange.	550° F.—Purple.
555° F.—Violet.	610° F.—White.
580° F.—Blue.	625° F.—Red.

In drawing the temper of tools, however, unless it is in some special lines, the colors are only observed for their utility, as indicating the proper temper, as the means for an end, while "bluing," technically speaking, is a process carried on for the specific purpose of causing the articles on which it is used to assume a blue color for ornamental purposes.

The process of bluing band springs for the rifles at the Springfield armory is thus given: "First, coat lightly with linseed oil; then sift dry hard-wood ashes over the springs with a sieve, until they are covered; place them in a furnace, and heat them until the color begins to change to a blue; after which they are cooled in the air, the ashes brushed off, and they are placed in a wire basket, and immersed in sperm oil; when taken out, they are washed in a solution of soda, to remove all oil. The linseed oil causes the ashes to stick. The process is called *ash bluing*" By coating them evenly with ashes they are not exposed to the direct access of air, and oxidation takes place slowly and uniformly.

Other small articles have from time immemorial been blued in sheet-iron pans, which, being provided with iron handles, can be shaken over the fire like a corn popper. The work is cleaned after it comes from the polishing wheel, by boiling it in soda water, washing in clear hot water, drying, and dusting with lime. Clean sand, which has been heated hot enough to drive out all smoky matter, is used in the pans. The pieces are put in, and shaken over the fire until they gradually come to the color desired. It is to be noted that they must appear to be a little overdrawn when they are taken off, because when they casually appear to be of a full blue, before oiling, they are apt to develop a red tint after they are oiled. The process appears very simple to a person looking on, but when he tries it himself he finds it will not be successful if the work is not clean, the sand clean, and the entire operation conducted with due regard to securing the proper degree of heat, and bringing the work uniformly under its influence.

The arrangements for conducting bluing operations on a large scale consist of a shallow iron pan, mounted over a fire-box and grate. A good size is two feet wide, six feet long, and eight or ten inches deep. Provision must be especially made for keeping up a steady heat. Hard-wood charcoal is used in the pan, and should be granulated, of a size to suit the work. As the necessary degree of heat required to produce the blue color on the work almost verges upon red-hot, the charcoal slowly ignites, is gradually consumed, and this loss must be repaired. Before it is ready to receive the polished pieces it must be heated and well shoveled over, to detect any little lumps that smolder, as the smudge from these would be likely to tarnish the work. The bright work is brushed off well with lime, to remove anything which would prevent the heat and air from acting uniformly upon its surface; otherwise it will have a mottled and dirty appearance, which cannot be corrected without repolishing. Pieces of irregular form, some parts of which are thicker than others, require a great deal of watchfulness, and skillful manipulation, to prevent thin parts from becoming heated before the thick ones. The fire must be kept down, to prevent the thin parts from being overheated before the thick parts have come to their color.

If polished steel is heated where it does not come in contact with the air, it does not oxidize, and therefore does not color. In the hot charcoal, the common air is kept out by other gases, and the work does not change color while it is buried, but immediately upon its being withdrawn from the coal, or uncovered, and exposed to the air, the colors flush upon it with great rapidity, running the full regular gamut of the steel spectrum;

for, although it may turn blue almost instantly, it becomes pale yellow first, and exhibits the other colors in regular succession, but in quick time.

Owing to the fact that the charcoal cannot always be kept at the proper heat to cause the articles to become blue when exposed, it is necessary to constantly bring them to sight, and change their positions, to secure their even heating, and when held by the tongs for this purpose, they are also carefully brushed with lime dust, to remove any foreign matter that may adhere to them. When they are judged to be of the right color they are carefully placed where they will not come in contact with anything to mar their surface, and are allowed to cool, after which they are oiled, and wiped clean.

An arrangement which sometimes occasions trouble is that the light in the bluing-room is not sufficiently good for the purpose. It is not good enough to certainly distinguish a full blue, in some part of the day, and if, by mistake arising from this cause, the work is allowed to cool before it is fully colored, it becomes very difficult to run it down again, as its phases cannot be watched unless some spot is brightened to serve as a guide.

Iron and steel of all kinds can be blued by heat, as it is a natural property of iron to acquire colors by heat, which is not lost during any transformation through which it passes, but cast-iron will not receive color any better than it will polish. There is a crust on castings of iron which has not the same "molekel" as their interior, and with the same heat acting upon it, this crust will not exhibit the same shade of blue that is shown by the interior where it is exposed by cutting through the crust. Pieces of malleableized cast-iron have the same fault, and even in a higher degree. During the civil war, when the government stood in need of guns, it allowed some of the private contractors of patent breech-loaders to make the butt plates of malleableized cast-iron, and although they were cast very "true to pattern," yet, in finishing, more stock would be removed from some places than from others, and whenever this was the case, the part from which the most was taken would present the appearance of a lighter blue than the surrounding parts. It was said to look "milky," and the inspectors condemned some for this cause. If they had been cased and heated in an atmosphere of carbon, just long enough to change the structure skin-deep, they would possibly have taken a more uniform color or shade; it might still have been light, but it would not have been clouded.

An excellent method of bluing has been introduced into the National Armory at Springfield, within a few years, by Col. Buffington, the commandant. It has proved so satisfactory in every respect that it has since been introduced into a number of private manufactories. The apparatus required for bluing by this method consists of a rectangular cast-iron tank of suitable dimensions. This is made rounding at all corners to diminish the liability of its cracking by expansion or contraction. It is permanently set over a furnace. The tanks in use at the armory are of sufficient size to hold a mixture of twenty pounds of black oxide of manganese, with one hundred and eighty pounds of nitrate of potassium (200 pounds of the mixture in the proportion of 1 to 9). When a fire is built in the furnace, underneath the tank, the saltpeter melts, and the manganese settles to the bottom in a thick, muddy sediment. When the workman is ready to commence operations, he stirs up the manganese, and then ascertains whether the bath is of the right temperature by throwing upon it a sprinkling of dry sawdust. If the conditions are right the sawdust will instantly sparkle and ignite, but if the bath is not quite hot enough the sawdust will glower for some time before taking fire.

If the bath is of the proper temperature, the work—which must be assuredly dry—is immersed in it, and allowed to remain there until it is heated to the same temperature. If it is tempered work, it is plunged for a few seconds into cold water, to set the temper, as soon as it is taken from the heating bath. In case the work is not tempered, this plunge is omitted. It is then dipped in boiling hot water for a moment, and then immersed in a tank of oil. When it is cool it is removed from the oil, allowed to drain, and subsequently wiped off; it is found to be of a beautiful dark blue, of greater depth and permanence than that obtained by other processes.

The Master Armorer, Mr. S. W. Porter, says that the results are more uniform, and are obtained quicker and with less expense by this process than by the old one. The same amount of work can now be done in one day which by the old plan required two and one-half days. Either iron or steel is thus blued. The iron guards and triggers are blued in this manner after they are assembled. They are not dipped in cold water.

Great caution is exercised to prevent the niter from coming in contact with the fire, on account of its expansive and explosive nature. The tanks are removed as soon as any signs of cracking appear, and others are substituted in their place.

A modification of the old process, now in use, is to wipe the piece over with oil when it has nearly reached the full blue, and let it come to its color while oiled. There is reason to suppose that the oil penetrates the steel to some extent, whether it is hot or cold, but to a greater depth when its particles are separated by heat.

As to the penetrability of steel, I will relate an incident: A friend once brought me a steel adjustable gauge 12″ to nickel-plate. He had made it himself, and etched his name on the bar. He had also got a spot of rust on the bar with the acid, about as large as a house fly's wings, which he pointed out particularly. The gauge was polished and nickel-plated to his satisfaction, and not a trace of the spot could be discovered; but in two years after, he called my attention to the fact that there was evident discoloration of the nickel over the spot.

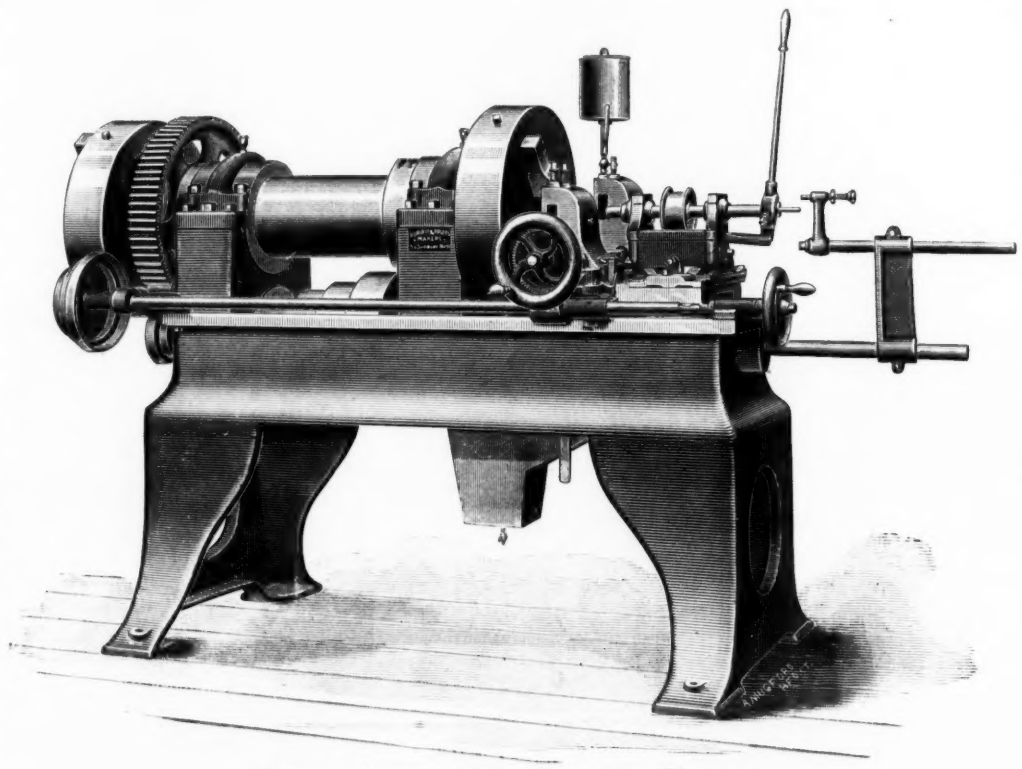
Hardened steel takes a high polish, and on this the blue shows to excellent advantage. It should do the same on chilled cast-iron, which takes a high polish as "speculum metal." There is a liability that cast-steel cast to pattern may lie somewhat under the same disadvantage as malleable cast-iron, and for the same reason; that is, on account of the difference in the molecular structure of the crust, and the interior. There is something of this in steel bars, but not much, as the ingots are generally cast large enough, so that they are much reduced in size by the time they are shaped into bars, and the crust of the casting is proportionally thinner.

The difference in the constitution of the various forms of iron will be noticed in the polishing. The sparks from any form of the metal, containing much carbon in such a state that it changes its condition with a slight variation of temperature, are red; while iron, low in carbon, or holding it firmly in combination, shows yellow, almost white sparks. This subject was discussed in the AMERICAN MACHINIST some years ago. It may be observed that the metal which polishes with dark red sparks takes a light shade in bluing.

New Six-inch Cutting-off and Centering Machine.

We have previous to this illustrated cutting-off machines in smaller sizes made by Hurlbut & Rogers, South Sudbury, Mass. The present illustration is of a machine made to cut stock up to six inches diameter, and to center it if desired. The sliding carriage is operated by the hand-wheel in front, and an automatic feed and automatic throw-off are provided.

The spindle bearing is 8¼ inches diameter,



SIX-INCH CUTTING-OFF AND CENTERING MACHINE.

and the spindle carries a heavy 20-inch chuck at each end.

The cutting is done by two tools, one being usually ground V-shape and the other square across, the V tool removing the stock from the center of cut and the square tool from the corners. There is an arrangement for quickly adjusting the tools, one to the other. The receptacle for chips and oil is seen below the bed.

Provision is made for eight changes of speed for the spindle. The countershaft carries two pairs of tight and loose pulleys.

The steamship Vigilancia, recently launched from Roach's yard at Chester, Pa., is 320 feet long, 45 feet beam, and 27 feet 9 inches deep. Her engines will be triple expansion, with cylinders 28″, 44″ and 70″ diameter, and a stroke of 48″. Her propeller is 15 feet 6 inches diameter, and 22 feet pitch. Six steel Scotch boilers, 12 feet diameter and 11 feet 7 inches long, will furnish steam. Forced draft will be employed. She is for the Brazilian line.

The total mileage of street railways—tramways—to date in the United States and Canada, is given as follows by the *Street Railway Journal:* Miles of horse railway, 5,902½; ditto electric, 1,753; ditto dummy, 556; ditto cable, 441; total mileage, 8,652½. Number of electric roads, 264; ditto cable roads, 44.

Riveted Joints.

The following article has been written in response to questions received relating to the design of riveted joints.

A very common practice in American boiler construction is to use single-riveted lap joints for the circular seams, and double-riveted lap joints for the longitudinal seams in boilers carrying a comparatively low steam pressure. For higher steam pressures, double-riveted lap joints are used for the circular seams, and double-riveted lap joints, with welt pieces, for the longitudinal seams. Sometimes welt pieces are also put over the circular seams up to the water line, for the purpose of preventing furrowing. In some cases butt joints are used.

The single-riveted lap joint is represented in Fig. 1 (page 3). It is the simplest kind of riveted joints. A double-riveted lap joint is represented in Fig. 2. The latter joint is, of course, stronger than the former. The reason for using a stronger joint for the longitudinal seams is, that every inch of this seam has to resist twice the stress of every inch in the circular seam. To prove this we will take the following example:

Let Fig. 3 represent a cylinder 36 inches diameter, 1 inch long, and conceive the shell to be very thin, so that for the purpose of investigation we may leave the thickness out of consideration; also let the steam pressure in the cylinder be 100 pounds per square inch.

The stress on any longitudinal line, as $a\ b$, will be equal to one-half the product obtained by multiplying the diameter, $d\ a$, by the steam pressure per square inch; hence we have

$$\frac{36 \times 100}{2} = 1{,}800 \text{ pounds},$$

which is the stress on the line $a\ b$ or $d\ e$, and since these lines are 1 inch long, we may say that this is the stress per inch of the longitudinal seam. The total stress on any circular line will be equal to the area of the head in square inches, multiplied by the steam pressure per square inch. The area of the head is 1,017.88 square inches, hence the total pressure on the head will be $1{,}017.88 \times 100 = 101{,}788$ pounds. But this pressure is resisted by the circumference of the cylinder, which is equal to

$$36 \times 3.1416 = 113.09+ \text{ inches}.$$

Here, then, we have 113.09 inches to resist 101,788 pounds, consequently each inch will have to resist

$$\frac{101{,}788}{113.90} = 900 \text{ pounds},$$

which is just one-half of the stress on the longitudinal line $a\ b$.

This can be proved in another way. Let p denote the steam pressure per square inch; d, the diameter in inches of a shell one inch long; T_l, the tension or stress per inch on the longitudinal seam; T_c, the tension per inch on the circular seam. Then

$$T_l = \frac{d \times p}{2};$$

and for the circular seam we have

$$T_c = \frac{d^2 \times .7854}{d \times 3.1416} \times p.$$

This last equation can be written as follows:

$$T_c = \frac{d \times d \times .7854}{d \times 4 \times .7854} \times p.$$

By canceling we have

$$T_c = \frac{d\ p}{4}$$

But

$$T_l = \frac{d\ p}{2};$$

which shows the tension or stress per inch of the circular seam is just one-half of that on one inch in the longitudinal seam. But from the foregoing it must not be understood that the double-riveted lap joints, when used in a boiler for the longitudinal seams, are twice as strong as the single-riveted lap joints used for the circular seams.

EFFECTS OF TENSION ON RIVETED JOINTS.

When a riveted joint is subjected to tension, fracture may occur in several ways, depending on the defects of construction.

Let the shaded portion in Fig. 4 represent a strip of a boiler shell, with a single-riveted lap joint, and let the width a be equal to the pitch of the rivets. It is evident that the strip is held together by the section of the metal whose width is equal to b; that is, the cross-sectional area of the metal between the rivets; it is also held together by the cross-sectional area of one rivet. Now, fracture may occur in the following ways:

First—By the metal breaking across in front of the rivet, as shown at c, Fig. 4, the action being similar to that of the fracture of a beam loaded at the center and fixed at the ends. The cause of failure lies in the fact of punching or drilling the rivet holes too close to the edge of the plate. It is, therefore, of great importance to place the rivets at a proper distance from the edge of the plate.

Prof. W. C. Unwin, in his "Elements of Machine Design," gives the following distances from the center of rivets to the edges of iron and steel plates:

TABLE I.

Diam. of rivets.	IRON PLATES. Distance from edge of plate to center line of rivets.	STEEL PLATES. Distance from edge of plate to center line of rivets.
½ inch.	1.00 inch.	0.86 inch.
⅝ "	1.14 "	0.98 "
¾ "	1.29 "	1.12 "
⅞ "	1.41 "	1.22 "
1 "	1.55 "	1.35 "
1⅛ "	1.67 "	1.46 "
1¼ "	1.80 "	1.57 "

Mr. R. Wilson, in his "Treatise on Steam Boilers," says: "The lap for single riveting should be equal to 3 times the diameter of the rivet, and never more than 3.3 times the diameter."

The ordinary practical rule is to make the distance from center line of rivets to the edge of plate equal to 1½ times the diameter of the rivet. For thin plates, up to ½ inch thick, we would recommend to make this distance 1⅝ times the diameter of the rivet for iron and steel plates.

If the lap is too great, there will be difficulty, owing to the elasticity of the metal, in calking the joint so as to make it steam-tight.

Second — Fracture may occur by crushing the plate and rivet, as shown in Fig. 5, causing the joint to become leaky and insecure. But if the diameter of the rivet is of the proportion to thickness of plate as given in Table II, trouble of this kind need not be anticipated.

Third — Fracture may occur by shearing the rivet, as shown in Fig. 6.

This is caused by placing the rivets too far apart, or using rivets too small in diameter. Here then the following question presents itself: What shall be the diameter of the rivets? This question leads us to consider the diameter of the smallest hole which can be punched through a plate of given thickness. In punching the hole, the area sheared by the punch is equal to $\pi\, d\, t$, in which π denotes the ratio of the diameter to the circumference, and is always equal to 3.1416; d, the diameter of hole; and t, the thickness of plate, all in inches. Now let c_s denote the resistance to shearing per square inch of metal, and let R_s be the total resistance to shearing, then we have

$$R_s = \pi\, d\, t\, c_s.$$

The strength of the punch is equal to the cross-sectional area multiplied by the resistance to crushing per square inch. Let c_c represent the resistance to crushing per square inch; and R_c the whole resistance to crushing. Remembering that the cross-sectional area of the punch is equal to $\frac{\pi}{4} d^2$, we have

$$R_c = \frac{\pi}{4} d^2 c_c$$

And when the total resistance to crushing is equal to the total resistance to shearing, we have $R_c = R_s$, or

$$\frac{\pi}{4} d^2\, c_c = \pi\, d\, t\, c$$

clearing of fractions, we have $\pi\, d^2\, c_c = 4\, \pi\, d\, t\, c_s$. Hence

$$d = \frac{4\, t\, c_s}{c_c}.$$

Therefore the diameter of the punch can never be less than $\frac{4\, t\, c_s}{c_c}$; if it is less the punch will be crushed. If, for instance, the thickness t of the plate is ½ inch, and the resistance c_s to shearing is 20 tons per square inch, and the resistance c_c to crushing is 80 tons per square inch, then by substituting for the letters their values in the formula, we have

$$d = \frac{4 \times \frac{1}{2} \times 20}{80} = \frac{1}{2} \text{ inch for the smallest}$$

diameter of the punch which can be used for a plate ½ inch thick; or, as will be seen in this particular case, the diameter of the punch is equal to the thickness of the plate.

In practice, of course, the diameter of the rivet holes is always larger than the thickness of the plate, so as to reduce the pressure per square inch on the punch.

In practice the diameter of the rivet is generally equal to ⅞ of the thickness of the plate plus ⅛ of an inch. Or, if d denotes the diameter of the rivet in inches, and t, the thickness of the plate in inches, we may give in place of the foregoing rule the symbolic expression,

$$d = \tfrac{7}{8} t + \tfrac{1}{8} \text{ of an inch.}$$

The diameters of the rivets in Table II have been found by the foregoing rule. The first column gives the thickness of the plates, and the second, the diameters of the rivets in the nearest $\frac{1}{16}$ of an inch found by calculations.

Fourth—Fracture may occur along the center line $x\, x$ of rivets, Fig. 4. It is caused by placing the rivets too close to each other. This leads us to the consideration of the pitch of rivets; that is, the distance between their centers.

TABLE II.

Thickness of Plate.	Diameter of Rivets.
⅜ of an inch	½ of an inch
7/16 " "	9/16 " "
½ " "	5/8 " "
9/16 " "	11/16 " "
⅝ " "	¾ " "
11/16 " "	13/16 " "
¾ " "	⅞ " "
13/16 " "	15/16 " "
⅞ " "	1 " "
15/16 " "	1 1/16 " "
1 " "	1 1/8 " "

The tensile strength of iron plates in the direction of the grain varies from about 42,000 to 50,000 pounds per square inch. Now, for the purpose of calculating the pitch of rivets, we should know the exact tensile strength; sometimes it is stamped on the plates, but when this is omitted we should cut testing strips, and find the tensile strength by actual tests. In the absence of this knowledge we shall assume that the tensile strength is 45,000 pounds per square inch.

Referring to Fig. 4 let the shaded portion represent a strip of boiler shell; the width a of this strip is equal to the pitch of the rivets.

Along the center line $x\, x$ of the rivets the width of the strip is necessarily reduced to the width b, and the amount of this reduction is equal to the diameter of the rivet. Now, if a square inch of metal can resist 45,000 pounds at a, it would appear that a square inch of metal will also resist 45,000 pounds at b. But this is not true; the reasons for this statement are as follows: First, referring to B, Fig. 4, we notice that the line $d\ e$, which represents the direction in which the pull or tension acts, does not pass through the center of the thickness of those portions of the plates which make up the riveted joint; hence the action of the tension on the joint is oblique, and, therefore, the plates at the joint cannot resist as great a pull as they can directly above or below the joint.

Second—Punching will reduce the tenacity of the plate along the line of rivet holes. The probable cause of the reduction of tenacity, or injury is, that in punching, the metal immediately surrounding the hole is squeezed laterally into the plate, giving this portion of the metal a permanent set, thereby reducing the strength of the plate. We believe that with a spiral punch the injury will not be as great as when the plates are punched with a common flat-ended punch. The recorded results of experiments made for determining the amount of reduction of strength caused by punching vary so much that it is impossible to state the correct amount. But experiments seem to indicate that, if the holes are punched somewhat too small, so that a ring of about .06 of an inch or more can be reamed out to bring the holes to the right size, the injury to the plate will practically amount to nothing; or, if the holes are punched to the right size, and the plates are annealed after punching, the original tenacity will be restored.

In the following calculations, we shall assume that the plates are not annealed, and that the holes are punched to the right size with an ordinary flat-ended punch, all of which is a common practice. And we shall further assume that the oblique action of the pull on the joint, combined with the loss due to punching, reduces the original strength of 45,000 pounds per square inch to 40,000 pounds per square inch; the latter amount we shall hereafter, for the sake of brevity, call the apparent strength.

It is reasonable to assume that in new boilers, properly made, friction exists between the parts of the plates which make up the joints, and this friction adds strength to the joints. But the contraction and expansion will in time reduce this friction to nothing; we shall therefore neglect it in computing the strength of the joint. Now, if the apparent strength of the plate at the joint is 40,000 pounds per square inch, as we have assumed, it will be evident that, if we multiply 40,000 pounds by the area of the section at b, that is, multiply 40,000 pounds by the thickness of the plate, and by the width b, we obtain the total stress which our shaded strip in Fig. 4 can resist, provided the rivet is strong enough Let R_r represent the total resistance of the plate at b; and let the distance in inches between the sides of the rivets be denoted by b; t, the thickness in inches of the plate; and c_r, the apparent strength per square inch, which is equal to 40,000 pounds. We then have

$$R_r = b \times t \times c_r. \quad (1)$$

Since the width a, of the shaded strip in Fig. 4, is equal to the pitch of the rivets, it follows that only one whole rivet can hold the two parts of the strip together. Now it must be readily perceived that, in order to make one part of the joint as strong as the other, one rivet must be capable of resisting just as great a pull as the plate at its section b.

In a lap joint the rivets are subjected, to a small extent, to an oblique shearing stress, and it is perhaps for this reason, and on account of the bending action of the plates, that the rivets do not offer as great a resistance to shearing as they would do when shearing takes place in a plane perpendicular to the axis of the rivets. Again, rivets in punched holes seem to offer a greater resistance to shearing than rivets in drilled holes. The difference is probably due to the sharp edges of the drilled holes, which seem to shear the rivets with less pressure or load than the blunter edges of a punched hole. We shall assume that the shearing resistance of iron rivets in punched holes is 46,000 pounds per square inch. The total shearing resistance of the rivet will then be equal to its cross-sectional area multiplied by 46,000. The cross-sectional area is equal to the square of the diameter multiplied by .7854. Now, putting R_s for the total shearing resistance of the rivet, d, the diameter of the rivet in inches, and c_s for the shearing resistance per square inch = 46,000 pounds, we have,

$$R_s = .7854 \times d^2 \times c_s \quad (2)$$

But since the total shearing resistance of the rivet must be equal to the strength of the plate at its section b, see Fig. 4, we have $R_s = R_r$; and according to Equation 1, $R_r = b \times t \times c_r$; in which b is the distance between the sides of the rivets. Now, this distance b is evidently equal to the pitch of the rivets minus the diameter of the rivet. Putting p for the pitch, and d for the diameter, we have,

$$R_r = (p - d) \times t \times c_r.$$

Since $R_s = R_r$, we have,

$$.7854 \times d^2 \times c_s = (p - d) \times t \times c_r.$$

From the foregoing we get,

$$\frac{.7854 \times d^2 \times c_s}{t \times c_r} + d = p.$$

But $.7854 \times d^2$ is equal to the cross-sectional area of the rivet; if we now put a for this area we have,

$$\frac{a \times c_s}{t + c_r} \times d = p. \quad (3)$$

Replacing c_s and c_r by their values as previously assumed, we have,

$$\frac{a \times 46{,}000}{t \times 40{,}000} + d = p. \quad (4)$$

Example.—Find the pitch of rivets in a single-riveted lap joint for an iron plate ¾ of an inch thick.

In Table I we find that the diameter of the rivet for a ¾-inch plate should be $1\frac{1}{16}$ inch. The cross-sectional area of the rivet is .8866 square inch. Now, substituting for the symbols in Formula 4, their values, we have,

$$\frac{.8866 \times 46{,}000}{.75 \times 40{,}000} + 1\tfrac{1}{16} = p = 2\tfrac{7}{16} \text{ inches.}$$

In this manner we have found the pitch of rivets in the nearest $\frac{1}{16}$ of an inch given in Column 3, Table III. It will be noticed that this pitch does not increase regularly with the thickness of the plates; it is therefore not adopted in practice. The pitch given in Column 4 (same table) is recommended, as it agrees closer with the average practice.

In Table III (page 4) it will be noticed that the pitch of rivets as recommended for thin plates is less than the calculated pitch. The reason for this reduction is to avoid the difficulty in calking. On the other hand, for thick plates the pitch of rivets as recommended is greater than the calculated pitch. The reason for this increase is twofold. First: In Formula 4 we have taken the nominal diameter of the rivet, not the real diameter; that is to say, the holes are always punched somewhat greater than the nominal diameter of the rivet; this, of course, decreases the amount

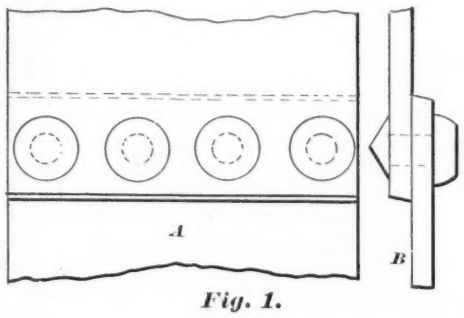


Fig. 1.

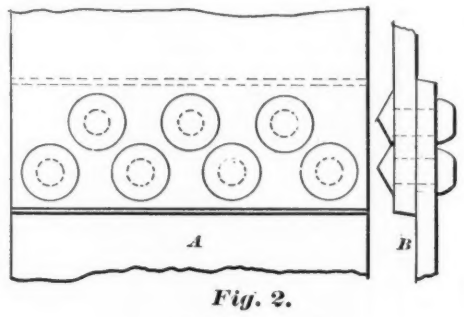


Fig. 2.

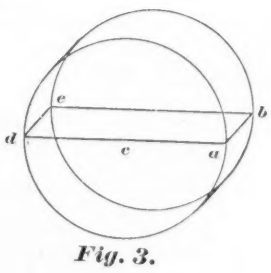


Fig. 3.

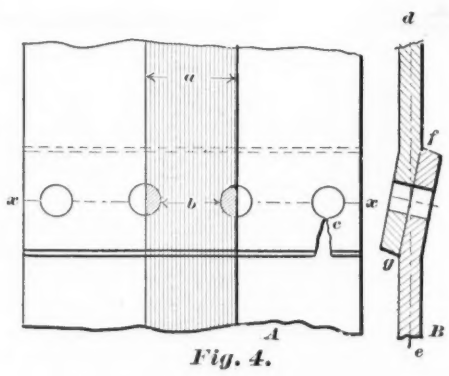


Fig. 4.

Fig. 5.

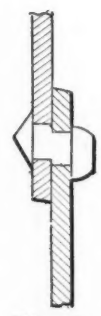


Fig. 6.

of metal between the rivets; and since the rivet generally fills the holes, the real diameter of the rivet is larger than its nominal diameter, and for this increase no allowance was made in the formula, hence we see the propriety of increasing the calculated pitch. Second: The edges of the plates will corrode or wear faster than the rivets. This fact indicates that the calculated pitch should be increased, provided it does not interfere with calking, and since thick plates are not so liable to spring, a limited increase of the calculated pitch, as given in Column 4, can be made without endangering the tightness of the joint. Without this increase of pitch the life of the boiler is shortened. Of course, for thin plates, an increase of the calculated pitch is prevented by the difficulty of calking.

TABLE III.

PITCH OF RIVETS FOR SINGLE-RIVETED LAP JOINTS FOR WROUGHT-IRON PLATES, PUNCHED, AND NOT ANNEALED.

Column 1. Thickness of Plates.	Column 2. Diameter of Rivets.	Column 3. Pitch as calculated by Formula 4.	Column 4. Pitch as recommended.
3/8 inch.	1/2 inch.	1 1/8 inch.	1 1/16 inch.
7/16 "	9/16 "	1 3/4 "	1 3/4 "
1/2 "	5/8 "	2 1/16 "	2 "
9/16 "	11/16 "	2 1/8 "	2 1/16 "
5/8 "	3/4 "	2 3/16 "	2 1/4 "
11/16 "	13/16 "	2 1/4 "	2 5/16 "
3/4 "	7/8 "	2 5/16 "	2 3/8 "
13/16 "	15/16 "	2 3/8 "	2 7/16 "
7/8 "	1 "	2 7/16 "	2 1/2 "
15/16 "	1 1/16 "	2 1/2 "	2 9/16 "
1 "	1 1/8 "	2 9/16 "	2 5/8 "
1 1/16 "	1 3/16 "	2 5/8 "	2 11/16 "
1 1/8 "	1 1/4 "	2 11/16 "	2 3/4 "
1 3/16 "	1 5/16 "	2 3/4 "	2 13/16 "
1 1/4 "	1 3/8 "	2 13/16 "	2 7/8 "
1 5/16 "	1 7/16 "	2 7/8 "	2 15/16 "
1 3/8 "	1 1/2 "	2 15/16 "	3 "
1 7/16 "	1 9/16 "	3 "	3 "
1 1/2 "	1 5/8 "	3 1/16 "	3 "

Many engineers assume the resistance of the plate between the rivet holes to be equal to the shearing resistance of the rivets. Under these conditions the formula for finding the pitch of rivets will be simpler than Formula 4. It is as follows:

$$\frac{a}{t} + d = p \quad (5)$$

In which a denotes the cross-sectional area of the rivet in square inches; t, the thickness of the plate in inches; d, the diameter of the rivet; and p, the pitch in inches.

The pitch found by this formula will be less than that given in Table III. We have stated that the resistance to shearing of the rivets in drilled holes is not as great as that of the rivets in punched holes, consequently when the holes are drilled it is advisable to reduce the pitch which is given in Table III, and adopt the pitch given in the following table, which has been calculated by the formula,

$$\frac{a}{t} + d = p.$$

This pitch is also more suitable for steel plates and iron rivets, or in all cases where the tensile strength of the plate and the shearing strength of the rivets are equal or nearly so.

TABLE IV.

PITCH OF RIVETS FOR SINGLE-RIVETED LAP JOINTS, CALCULATED BY FORMULA $\frac{a}{t} + d = p$; SUITABLE FOR WROUGHT-IRON PLATES WITH DRILLED HOLES, OR STEEL PLATES WITH IRON RIVETS.

Column 1. Thickness of Plates.	Column 2. Diameter of Rivets.	Column 3. Pitch of Rivets as calculated by formula.	Column 4. Pitch of Rivets recommended.
3/8 inch.	1/2 inch.	1 3/8 inch.	1 1/4 inch.
7/16 "	9/16 "	1 1/2 "	1 5/8 "
1/2 "	5/8 "	1 5/8 "	1 3/4 "
9/16 "	11/16 "	1 11/16 "	1 7/8 "
5/8 "	3/4 "	1 3/4 "	2 "
11/16 "	13/16 "	1 13/16 "	2 "
3/4 "	7/8 "	2 "	2 1/16 "
13/16 "	15/16 "	2 1/16 "	2 1/8 "
7/8 "	1 "	2 1/8 "	2 3/16 "
15/16 "	1 1/16 "	2 3/16 "	2 1/4 "
1 "	1 1/8 "	2 1/4 "	2 5/16 "
1 1/16 "	1 3/16 "	2 5/16 "	2 3/8 "
1 1/8 "	1 1/4 "	2 3/8 "	2 7/16 "
1 3/16 "	1 5/16 "	2 7/16 "	2 1/2 "
1 1/4 "	1 3/8 "	2 1/2 "	2 9/16 "
1 5/16 "	1 7/16 "	2 9/16 "	2 5/8 "
1 3/8 "	1 1/2 "	2 5/8 "	2 11/16 "
1 7/16 "	1 9/16 "	2 11/16 "	2 3/4 "
1 1/2 "	1 5/8 "	2 3/4 "	2 13/16 "

In another issue we shall give the pitch for double-riveted joints.

The number of miles of Hungarian State railway open to traffic in 1889 was 6,570, of which 4,415 were either owned by government or under direct government control. In 1888 the number of locomotives was 1,612, of passenger carriages 2,776, and of goods wagons 34,299.

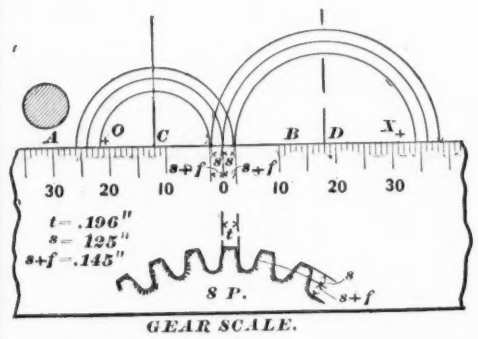
There is every probability that Paris will be made a seaport by the construction of a ship canal from Rouen, now the head of navigation on the Seine. The proposed canal is to be six meters in depth.

Not in Grooves—A Good Gear Scale.

By Jarno.

After some men have become fairly proficient in any calling, it has often been said that they tend to fall into ruts and there remain. I suppose this saying was started by some one accustomed to drive in a country where the streets are not paved, or where the roads are bad. To me, a machinist, and more accustomed to seeing grooves than to driving over bad roads, it would be more natural to say that some men tend to run in grooves. To carry out the figure, the grooves wear deeper and deeper, as they are followed, and their sides become smoother, so that it is constantly harder for any man to get out. This saying is applicable, generally to persons that are inclined to do things in the old way and are averse to trying new ways, and particularly to persons that do not think and act as I do. It does not apply to Geo. H. Smith, because he designed a good gear scale, and has just now improved upon the design.

This scale gives the relations of pitch, number of teeth and radii of a gear; and being double, or reading both ways from the zero line which is in the middle, it also gives the relations and center distance of two gears in mesh. Most gear scales are divided into diameter pitches, so as to measure the diameter of a gear; Mr. Smith's scale is divided into half diameter pitches, so as to measure the radius of a gear. The first line for each set of divisions is at a distance of ten divisions from the zero line. Thus, letting the scale shown in the figure be for 8 diametral pitch, the length of each division at A and B is one-sixteenth inch, and from the zero line to the first line for these divisions, the distance is ten-sixteenths of an inch. To help in reading they are conveniently numbered in tens. On each side of zero there is a line distant from zero equal to the addendum or face of a tooth; this distance is often designated by s, and for 8 pitch it is equal to one-eighth of an inch. On each side of zero there is also a line distant from zero equal to the flank of a tooth; this distance is often designated by $s + f$, and for 8 pitch it is .145 inch. Near the zero line is a sketch of a few teeth of 8 pitch, in which the length of face is shown at s, the flank at $s + f$, and the thickness of teeth on the pitch line at t. These sizes are also given in a little table near the sketch. We can have also data for sizes of rim, arms and hub of a gear. Mr. Smith has a sketch and data of bevel gears on each of his scales. In the figure, I illustrate the scale as applied only to spur gears. A draftsman's individual wants will guide as to making up a scale.



GEAR SCALE.

Now let us see what we can do with this scale. Of the three things—the diameter, the pitch and the number of teeth—two must be known, in order to figure the parts of a gear. The sketch of tooth sizes on each scale helps in choosing the pitch. In using the scale, the zero line corresponds to a point in a pitch circle; or, in the case of two gears in mesh, to the common point of the two pitch circles; and a line of the scale, A or B, corresponds to the center of a gear, or, in the case of two gears in mesh, a line of one of the scales corresponds to the center of one gear, and a line of the other scale to the center of the other gear. Having decided upon a few things in regard to two gears that are to be in mesh, the scale helps to determine the rest. For example, suppose that we decide that two gears shall have 8 pitch, one twelve and the other eighteen teeth, that the centers shall be in the line A B, and that the center of the twelve-tooth gear be at C. We place the edge of the 8-pitch scale upon the line A B, letting a twelfth division line, as figured, come upon the point C. Now, the zero line determines the common point of the two pitch circles, and the eighteenth division line, on the other side of zero, determines the center of the eighteen-tooth gear. The two s or addendum lines, one on each side of zero, determine points in the addendum or outside circles. In the figure the outside circles are shown, but not the working depth circles. The $s + f$ or flank lines, one on each side of zero, determine points in the whole depth circles; these circles are shown.

As another example, suppose that we decide that two gears shall have 8 pitch, and that the distance between their centers, as at O and X, shall be three and one-eighth inches, or fifty-sixteenths of an inch. We place the edge of the scale upon the points O and X, and at once see that between them there are fifty divisions of the scale, which means that the sum of the teeth in both gears will be fifty. Now, we can move the scale endwise, keeping the edge upon O and X, with the zero between, and the zero line will determine the common point of the pitch circles of any two 8 pitch gears in mesh, whose centers are at O and X, and a division line in A or B will indicate the number of teeth in each of the two gears. In the position that the scale now is, the zero line determines the common point in the pitch circles of gears, one of twenty teeth, and the other of thirty.

As a third example, suppose that we decide to have the centers of two 8-pitch gears at C and D, and that the gear at C must clear a shaft or obstruction shown in section at A. By swinging the scale around we can determine the largest gear that will clear A. Obviously it cannot be much larger than the twelve-tooth gear now shown; possibly it can have thirteen teeth, in which case the gear on D will have seventeen teeth.

A convenient length of scale is one hundred divisions each way from zero, two hundred in all. Mr. Smith makes the scales of paper on the drawing board, one for each pitch. Being made of paper, they follow the drawing paper in its changes with the weather.

"That notion of yours, Jarno," says Gascon, "that there is any advantage to be gained from a scale's changing with the paper, or that one can so change, comes from a myth. I find an intimation of this myth, published fifty years ago; it is continually republished in catalogues of drawing instruments, but no draftsman ever takes any notice of it, or ever heard of any one that does notice it. It is high time that this myth be dropped. Some drawing paper changes six times as much crosswise as it does lengthwise. It is a peculiar scale that can follow this paper; it must be a boomerang scale."

I reply that the making of a scale out of paper has nothing to do with Mr. Smith's invention, and that the fact of his using these scales for a considerable time in his own practice is good evidence in their favor. The remark about their changes was mine, and not Mr. Smith's.

The electric course indicator, an English invention, about which considerable has been said, appears to be a very simple apparatus by which the light is reflected to port or starboard, as the case may be, thus giving warning to an approaching vessel of the course that will be passed over.

For the cementing of iron railing tops, iron gratings to stoves, etc., the following mixture is recommended; in fact, with such effect has it been used as to resist the blows of a sledge-hammer: Equal parts of sulphur and white lead, with about one-sixth proportion of borax, the three being thoroughly incorporated together, so as to form one homogeneous mass. When the application is to be made of this composition, it is wet with strong sulphuric acid, and a thin layer of it is placed between the two pieces of iron, these being at once pressed together. In five days it will be perfectly dry—according to the *Chemical Trade Journal*—all traces of the cement having vanished, and the work having every appearance of welding.

Elevating Deck Ferry Steamer.

A ferry steamer of unique and patented design is now at work at Finnieston, in Glasgow harbor. The main feature of the steamer is an elevating deck, which can be raised or lowered by bevel and worm gearing, so that at any state of the tide the deck may be brought to same level as the quay for the shipment of horses, vehicles, or railway cars. The vessel has four screws, to give her great maneuvering facilities. The following dimensions have been taken from *Engineering*:

The steamer Finnieston is 80 feet long and 43 feet broad. The width of the deck is the same from end to end. The depth amidships is 12 feet, and the draught when fully laden is 9½ feet. The hull is built of steel, and is covered by a decking of iron. Internally it is divided by thirteen bulkheads, five of them transverse. The machinery is placed in the center of the vessel, while a boiler on either side is a boiler. Under this deck also is fitted the accommodation for the crew.

The elevating deck, when in its lowest position, rests on this iron decking, while the sides are clear for the funnels, for auxiliary steering gear, etc. The elevating deck is 78 feet long, and its extreme breadth is 32 feet. The central part is 19 feet wide, being laid out for vehicles, and the 6 feet on each side are reserved for passengers. The vertical screws carrying the elevating deck are supported by six columns, each formed of two box-girders 12 inches by 14 inches channel section, and these are 2 feet apart. They are riveted to the deck by angle irons 6 inches by 6 inches by ⅝ inch. In the space intervening between the box-girders forming each column, is an upright buttress screw 7 inches in diameter, and on turning it by bevel gearing, the platform is moved up or down. The screws are of forged steel, and at bottom there is a flange socket, by which they are secured to the deck with seven bolts. At the top the screw works in a manganese bronze casing, bolted to the inside of both columns and placed so that the platform may rise 14 feet. The nut is enclosed in a steel casting fitting between the box-girders forming the columns and having several guide bars working against the girders, and keeping the nut-box in position. The nut is of manganese bronze. The platform is supported on two fore-and-aft girders, and these rest on and are bolted to the nut casting. These girders are of I-section, 13½ inches deep, and are of channel iron. Resting on the part of the nut casting to the outside of the box-girders, are girders of similar construction for the wings, for passenger traffic. There is an iron casing to protect passengers from the vertical screw. The cross-girders carrying the elevating platform are 9 inches by 5 inches, of I-section, and are at 3 feet centers. The platform for vehicular traffic is of pitch pine, cross cleaded with elm planking, and two lines of rails are laid from end to end for railway wagons.

The box-girders on each side of the vessel are connected at the top by a girder I-section, 12 inches by 6 inches, of steel, and from it are side struts of similar size secured to the deck at the gunwale by rivets, and having a large knee-joint connected with angle irons. The diagonal tension bracings of the side struts are connected on a center ring, and are screwed up with nuts. Forward and aft the struts are carried to the deck as at the sides, while cross-girders connect the port upright girders with those on the starboard side. It may in this connection be mentioned that the center cross-girder has been strengthened to carry the wheel-house with steam steering gear, and from this elevation the vessel is manipulated, there being also telegraphic communication with the engine-room. There is also steering gear on the part of the deck not affected by the bridge.

The machinery for propelling the vessel and for operating the elevating deck is placed in one compartment in the center of the vessel under the permanent deck, while the boilers are at either side under that part of the deck not affected by the elevating platform. There are two horizontal tubular boilers 7 feet in diameter by 7 feet 6 inches long, constructed of Siemens-Martin steel and to the Board of Trade requirements, for a working pressure of 150 pounds to the square inch. Each boiler has one furnace, and the heating surface is 1,100 square feet. There are three sets of triple-expansion

engines, all of the same design and size, and all placed horizontally. They have each cylinders 9 inches, 14½ inches, and 24 inches in diameter respectively, with a piston stroke of 18 inches. Two of the sets are placed athwartship, the one driving a line of shafting running fore and aft and operating the port screws at both ends of the vessel, while the other drives the shafting for the starboard screws. The third set is placed between the two propelling engines, and lies with pistons working in a fore-and-aft plane, driving a line of shafting running athwartship, and connecting through spur and bevel wheels with two lines of fore-and-aft shafting, of wrought steel 4½ inches in diameter, geared on their respective sides to each of the vertical screws for raising or lowering the platform. The gearing wheels are mostly of gun-metal. The gearing is so designed that a variation of speed can be obtained according to the weight of the load to be raised or lowered. The elevating deck may be raised 14 feet.

The engines are all fitted with Brown's patent steam and hydraulic starting and reversing gear, to insure promptitude. The air and circulating feed and bilge pumps are worked independently of the main engines, owing to the short time these are at work. In the event of either set of engines being disabled, provision has been made whereby the remaining set may propel the vessel. The collective horse-power of the propelling engines is 320 indicated.

A rudder has been placed at each end of the vessel, and each rudder has a movable lock-bar to keep it in position when the other is being used. The twin propellers at either end are protected by three rods so placed to prevent mooring ropes becoming entangled with the rudders.

The vessel has accommodation for about 300 passengers, besides eight loaded carts with horses, or the same number of passengers with four loaded lorries and three loaded carts, or for 600 or 700 passengers only.

These are big figures, and show what co-operation can accomplish if the enterprise is properly handled: The celebrated Rochdale co-operators, who started only twenty-six years ago on the humblest scale imaginable, have a capital stock, every share of which is held by a wage earner, of $2,355,000; profits distributed to members have reached $200,000,000, while the total sales for 1889 showed an increase over those of 1888 of $10,000,000.

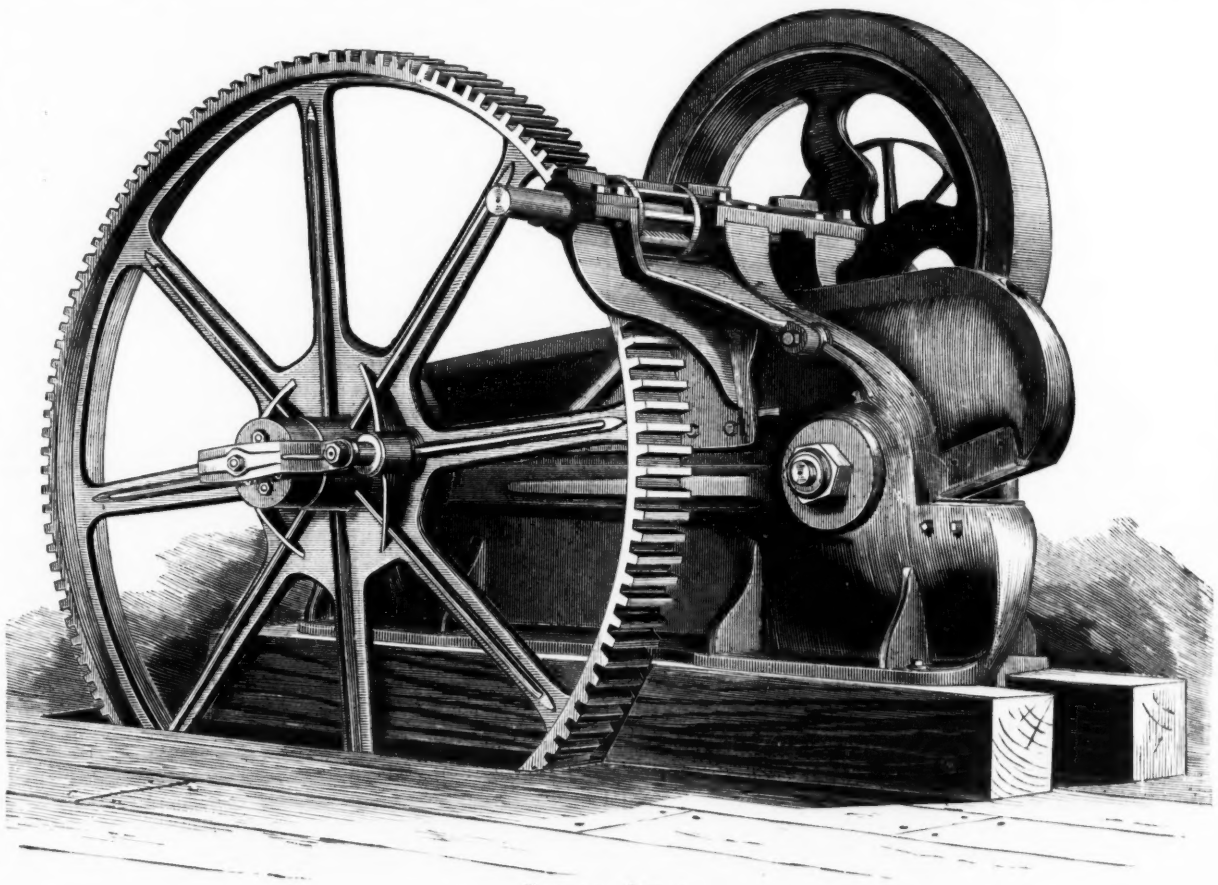
The trial of electric cars on a surface road in Jersey has so far proved very satisfactory, and it seems probable that their use will be extended.

Bar-iron Shear.

The engraving herewith represents a bar-iron shear, made by the New Doty Manufacturing Company, Janesville, Wis. It is of the usual lever type, operated by a cam. The cam is of such shape that it makes the cut quickly, and then permits the lever to stand still an instant before another cut. This allows time to adjust the iron between the two cuts without stopping the machine. The machine starts and stops with a clutch that may be operated by either a hand lever or a treadle.

The knives for round iron are rounded out so as not to flatten it in cutting. Both sets of knives—for round iron and for flat iron—are at all times ready for use without any change.

Progresso, an Italian contemporary, says iron articles can be protected from rust by sinking them near the negative pole of an electric bath composed of ten liters of water, fifty grammes of chloride of manganese, and 200 grammes of nitrate of ammonia. Under the influence of the current the bath deposits on the articles a film of metallic manganese, which prevents them from rusting.



BAR-IRON SHEAR.

Some Experience—The Old and the New.

BY A MECHANIC.

Some years ago, becoming tired of the sameness of the work in the shop where I was then employed, and feeling that if I stayed there much longer I would turn into an old work-horse, I resolved to make a change, whether for better or worse. I found a job in a large city not far distant, in a shop which had been shut down for a number of years, but had been recently started again. I had a long talk with the foreman, who seemed to be a nice man and very courteous. He wanted to know what experience I had had; what kind of work I had been used to. My answers seemed to be satisfactory, and I hired with him for a general machinist. The next morning I went there to work, and after donning my suit of overalls I presented myself to the foreman. I was surprised to find that his gentlemanly and courteous manners were entirely changed. He addressed me in the same manner that a master might a new-bought slave: "What do you let yourself for?" I did not wish to pick a row the first day in the shop, so did not give him the answer I wanted to. I sell my labor, but I never let myself. A person may hire a house and be at liberty to adorn the walls with comic pictures for his own amusement, or do anything else, so long as he does not damage the property or its reputation; but no man can hire an American mechanic and adorn his back with pictures or mottoes for his own amusement. A mechanic does not hire to amuse anybody, but to do honest work for honest pay. This touches the system of "bulldozing." "Bulldozing" is the way some bosses have of trying to amuse themselves at the expense of the men who are doing work for them.

After the boss had got through with his bulldozing, he turned me over to a young fellow, who looked to me as though he had been picked out for what he did not know, because he did not have any respect for anybody, and therefore, would make a good "driver."

I was at last shown the work and my lathe. I had seen poor lathes before: lathes with wooden beds and cast-iron track screwed on, about the same as is used for barn doors to slide on; lathes with chain feed and a steering wheel always "far, far away"; very convenient when squaring a shoulder or end of a long shaft, to go to the other end of the lathe and give the wheel a jerk, and then go back and see what effect it had on the work; whether the tool was broken or the work spoiled. But with these lathes, after we got used to them, we could do good work. We could put blocks of wood on the ways, to fill the space between tail-stock and the carriage, and with a short bar of iron for a lever, and the last block of wood in the row for a fulcrum, we could pry the carriage along with the advantage of seeing the effects of each pry. The carriage was held down by a big weight, which would hold it down, no matter how far down it went, till the weight brought up on the floor. We could turn a shaft about straight by following the tool close with the calipers and keep pushing in or pulling out the tool as the measurements varied.

But with my lathe in this shop the case was different. It had gone so far to the bad, under the management of the "driver," that it was even beyond the reach of schemes. It was one of these kind of lathes that, when turning a shaft, it is necessary to crowd the tool till the spring of the parts equals the pressure of the cut, and then, if the feed is thrown out without pulling out the tool first, the thing will retaliate by cutting the shaft off.

The job I had to do first was this: As I understood, it was for hollow shafts. A piece of 2-inch gas-pipe about 6 feet long, with wrought-iron collars shrunk on each end. These collars were to be turned to fit bored holes in castings, which castings made bearings for the central shaft (I had to guess about this, for the boss, of course, would not tell me). It was necessary, you will see, to have the hole in the pipe about central with the outside of the collars, as the central shaft nearly filled the pipe.

The way I started to do this job was this: I found a pair of old cone centers in a scrap box under the lathe. Putting one of these centers in the spindle, I was about to put on the back rest, and by holding the work at one end on the center, with a bolt in the face-plate, with the other end in the back rest running on the pipe, I was going to chamfer the inside corner with a tool to fit the cone center. I was stopped by the boss: "What are you doing? Don't you know how to do that job? That won't do at all. Take that right off. We have the time all made up that it takes to do that job, and that way won't do at all."

I did not have anything to say to this, except that, if he had anything better to do the job with he had better produce it. This seemed to be an idea for him, for he started right off. After a while he came back with a large cone-shaped mill. It had a taper shank, and the tail spindle had a taper hole; of course these must fit. With some people anything will fit a taper hole. He drove this into the tail spindle with a hammer. These tapers conformed about as near as $\frac{1}{16}$ inch in 6 inches. The fit was on the small end, so no matter how hard he drove it in, it was still quite a universal affair.

"Go ahead and center them with that." I went ahead, but they would not center with that. I tried, as is done, with a square center. It was of no use; there was so much spring about that lathe it would conform to almost anything. The mill was very dull, and so was everything else I saw in that shop.

After a while I gave up the square center plan, and thought I would try a scheme. I put the mill in the other end of the lathe—in the live spindle. I packed it in paper, not for safe keeping, but to confine it to one locality. I then pressed the pipe on it hard enough to make it drive, and started up the lathe, and, by holding a piece of chalk, marked where it was out, and then held the pipe from turning with a dog, and, by pressing the pipe over, milled out the stock. As I said before, the mill was dull, and it took about all my strength to screw the tool block over with force enough to make it cut, but I was beginning to learn that strength was needed to run that lathe, for it had got used to that kind of treatment. I was getting along pretty well in this way when the boss showed up again.

"Now what are you doing? Don't you know how to use that? Why don't you use it the same as a square center?"

I explained to him how it worked as a square center. He turned around and walked off without saying anything more.

I think there were eight of these pieces. After a while I got them centered; I then looked for lathe tools. I found one old side tool, which was all used up and unfit for further use, and a diamond point which was about two inches too high. I went to my neighbors to inquire, but was not able to make them understand. I don't think there was a man on that floor but the boss and I who could speak English. (This was in the United States.)

After a while I found the boss, who told me I would have to find what I could and carry them down to the tool dresser and have them fixed. I found another old side tool and carried them down to the tool dresser. The tool dresser was a good many, I found. There were at least twelve men with irons in that fire, and two working on the anvil at one time with different jobs. I happened to see a man running a planer a little ways from there, who I had seen before somewhere, and knew he could speak English, so I went to him for assistance. He told me the tool dresser was out on a drunk, and had not been around for two weeks; that that was a funny shop. I had begun to think so. My father was a blacksmith, and I have worked considerably with him, and can fix tools, but I would not attempt to work with so much help. I carried the tools back again the way they were, and managed to grind up one of the side tools so as to do a little with it. I managed, I think, to get two or three turned up by about a quarter of 6 P. M., when the boss came rushing up, all out of breath, and told me he had made a mistake in the length, and that they were all two feet too long; that I would have the next morning to cut them off and shrink the collars on again.

The next morning I did not come in. Perhaps he thought I saw the need of going on a drunk. I went back in the afternoon

and got my tools. I have often wondered if he got that job done on time.

Upon inquiry, I learned that all the experience in a machine shop this man had ever had to qualify him for a foreman, was a short time he had acted as a clerk for another foreman. He had never done, himself, any kind of work in a machine shop, except run errands and write.

The next shop I went to work in, I found they too had a "driver" foreman, but not as bad as the last. I worked in that shop about six months, and had time to note some of the peculiarities. When the boss gave a job to a workman, he gave him to understand, with his other instructions, that there was not quite time to do the job, but if he would work for his life he might be spared. Everywhere in that shop I saw the results of so much hurry. If a man was doing a job on a planer, and had got ready to take it off, there was no attention paid for the next job those tools might be used for, but the great sweat was to get that job off and present it to the foreman "on time." There was one big box, and the surrounding floor, which held all the special tools for planing. If a strap and bolt could be got off together, they were thrown in that way into the common stock. Nuts were never put back on bolts after using; it would take too much time. Tools were never cleaned after using. On the next job the wreck would be cleared away just enough to allow that job to be done, and no more. There were very seldom any repairs made, and never any new tools.

The question that occurred to me was: How did this thing start? There were the remains of a good shop outfit. Somebody must have made these tools. There were racks on the walls, which had been used for holding tools not in use, but they were never used now. I saw pins which had evidently been used for holding bolts by the head. On going closer, and brushing the dust away, I found what had been white paper tags pasted over these pins, with the lengths of bolts that were supposed to be kept there. I saw everywhere evidence of a different kind of management from the present one. My curiosity being aroused, I made some inquiries of some of the older workmen, and learned that there had been a progressive foreman there a few years ago, who had fixed the shop up so they could work, but he did not suit the managers. There was no need of asking more. The rest is easily guessed. The old saying illustrated, "Man shall earn his bread by the sweat of his brow." Many have to see the sweat before they will believe a man is working. The progressive foreman did not "let to-morrow take care of things of itself," but planned to live another day. He arranged things in such a way that a large amount of work could be done with little labor. This did not suit the managers, for they thought the workmen were taking things altogether too easily.

I heard of a case in an old-time shop. A small upright drill was bought. It was found necessary to sit, while working on it, for the table was low. The manager could not bear to see a man sitting at work, so he had that drill set up on a big pine block. I have seen a man doing a job, working in the hardest kind of a way, and I have seen another man do the same kind of a job in one-half the time, and without appearing to be working hard at all. It seems the sweat proof of work done can't be taken without some consideration. By the use of special tools and a good system of management work can be done very cheaply. It is very hard to predict the limit that any kind of work can go in this way.

There are shops now adopting these improved ways of working. Other places, in order to compete, are obliged to grind all that is possible out of their workmen. Some have already gone so far that they now cannot hire American workmen cheap enough, and are obliged to hire others. There is but one way that this can end, that is, the ones who do not keep pace with the times will have to step out of the race.

At the time of the Aztecs in Mexico we are told there was a sort of quick express and mail system carried on between the city of Mexico and the coast. The conveyance was a man who would take the message or whatever it might be, and run with all his might to the next station, where a fresh man would take it, and so on. Does any one doubt that if such a system was established to-day, in competition with the railroads and telegraphs, that it could not live, even if the help was paid absolutely nothing? It takes a kind of bravery to invest a large amount of money on special tool, where there is no real way of knowing whether the undertaking will be a success or not, till tried. It does not require much to copy our fathers, and depend on grinding the profits out of the workmen. The future successful machine shop will be one where the mind is used as well as the hands. Self-conceit is a trait of human nature. A machine shop manager usually considers it a matter of great honor to devise anything new. He considers himself very smart, and usually takes a suggestion from any one as an insult.

I believe this is wrong. I cannot see why an invention should entitle any one to any more credit than any other kind of work. Need a man be so very smart to devise anything new? Some are gifted with originality, and are lacking in other essential things. I believe, if this idea of honor, of credit, of smartness was overcome, and the suggestions and little schemes were regarded as all other work, that things would be much improved.

A man may be smart, he may be gifted with originality, and he may study for a long time, and devise something which he believes to be just right, and can't see any way to improve it. He may then allow one hundred men to study the same subject, and perhaps no one of them may possess the talents he himself does, but each one's mind travels a different course; there will be oceans of space covered that he never thought of, and no doubt good suggestions made. If I owned a machine shop, I would post this notice in the place of the usual "Rules and Regulations."

A STANDING OFFER.

It is one object of this firm to employ the minds as well as the hands of workmen.

Anybody in the employ of this firm may believe that he is considered to have good sound common sense, or he would not be employed here.

There are oceans of undeveloped schemes that will be useful to this firm. We make this standing offer to anybody who will devise anything in the way of special tools, or ways of working which will be useful to us, and within our reach, to carefully study into the merits of each and every one, and accept and pay according to the merits of the schemes proposed, the same as for all other work. ——, Manager.

Of course a great many of the schemes proposed would need developing. It might need an expert to design the parts so as to do good service, but it is the germ of thought we want to get. You say you are bothered now with too many schemes, and not enough worked out. Look a little deeper, and see if it is not the many that are not good that bother you the most. Is it not out of the many that we pick out the best? A person is liable to favor his own ideas, and so does not judge correctly sometimes, but with the ideas of others he sees things in their true light.

Lessons from the New Navy.

One of the most noticeable things about the new navy is the way in which it is bringing the young officers to the front. In all the departments—naval construction, steam engineering, ordnance, and navigation—new improvements and new methods are constantly supplanting the old, and an officer must be a close student and a hard worker to keep abreast of the times.

Modern ships are immense fighting machines, in which all the latest improvements in electricity and magnetism, steam engineering, and ordnance are combined. Naturally, the young men, who have most of their professional careers before them, enter with more enthusiasm into these studies than the older ones, whose service is nearing an end, and who made very efficient officers in the old class of vessels, containing little machinery and the old-style guns, and lighted with oil instead of electricity. When these older officers have gone into the new ships, in several instances they have found so much in their duties that was new to them that the increased labor and responsibility have broken down their health, and they have had to give way to younger men.

One of the immediate results of this state of affairs will probably be the early retirement for disability of several of the older officers in the service.

The improvements in material have also made necessary a higher average of intelligence among the enlisted men, and one of the most pressing needs of the service is some system that will secure better recruits, especially for petty officers and machinists. Sails have almost entirely disappeared from the navy, and while a large proportion of the enlisted men should undoubtedly be seamen, they should be at the same time men capable of not only learning the routine of the great-gun and rapid-fire gun drills, but of understanding the principles on which the guns are made as well. In the modern ships, in addition to the great triple-expansion main engines, with all their complicated parts, there are dynamos, blowers, steam steerers, and auxiliary engines of all kinds and sizes, scattered in widely-separated parts of the vessel, and with the small number of engineers carried, a large and intelligent force of machinists is a pressing necessity.

On every one of the new ships there has been complaint about the difficulty of getting a sufficient number of good men. Men such as are needed can command good wages on shore, and to induce them to serve on shipboard two things are needed—good pay and good quarters on the ship. There is considerable complaint on the new ships about the contraction of quarters. Of necessity, much space given to quarters in the old ships is utilized for machinery and other purposes in the new, but all the contraction has been in the quarters of the crew and the junior officers, while in the cabins of the admiral and the captain the tendency is to expand rather than to contract.—Washington Correspondence *N. Y. Times*.

LETTERS FROM PRACTICAL MEN.

Critical Notes.

Editor American Machinist:

Mr. Bullock's reply to my note about the loss by the indicator pipe leads me to think that I failed to make myself clearly understood about it, and I will try again.

I assert that the only loss of steam by filling the indicator pipe, when compression is sufficient to reach initial pressure, and expansion runs down so that exhaust takes place at atmospheric pressure, is that due to condensation in the pipe, and the extra friction caused upon the engine while doing the compressing. It is true that the compressing must be done by the power of the engine, but the compressed steam is like a spring, and, if allowed to expand again, it gives back to the engine all the power used, minus the extra friction on the engine caused by compression, so the friction and the extra condensation due to larger surface in the clearance space is the only loss caused by clearance space in such a case. If the clearance be filled by steam from the boiler instead of compression, then the loss will always be the cubical contents of clearance space by the terminal pressure. Therefore it should be obvious that it costs less to fill the clearance space with compression, when it can be expanded again, than to fill it with steam direct from the boiler. In no case would the loss by filling the indicator pipe be equal to the area of the pipe multiplied by the mean effective pressure, for the greatest possible amount that can be wasted would be the pipe full at terminal pressure. Although compression can be used to advantage in filling the clearance space, it does not follow that it can be used to fill an unlimited quantity of space, and I think it does not pay to undertake to fill a clearance space exceeding 12 per cent. of the piston displacement; but any clearance within that amount can be filled most economically by compression. Bell Crank.

Economy in the Foundry.

Editor American Machinist:

"Nails are cheap enough." This is what I heard a molder say the other day as he was walking through the shop with more nails in his hand than he could conveniently handle, and consequently was dropping them on the ground.

Yes, that is a fact, by the single or dozen; but if every molder went to the keg for a handful of nails and lost half before he got to his floor, nails would cost a great deal.

There is a foundry not a hundred miles from this place (Cleveland) where the nail keg was left open to everybody that came along to take a grab, and that made the proprietors think they were paying too much money for nails. So they made a rule that no nails were to be given out without an order from the foreman. The result was surprising. Instead of using up five kegs a week, one keg in five weeks sufficed.

And I think it is a very good rule, as it makes men more thoughtful of their interests, and likewise of the interests of the proprietors, instead of throwing out all that accumulates in the riddle after a lot of the sand from the heap has gone through it.

Look it over, and pick out all the nails and spikes, and put them in a box, and then when you want some you will know where to get them without going to the foreman for an order. He has plenty to do without writing orders.

Another thing is the willful waste of flour. It seems to me that some molders could not work in a foundry if there was no flour to be had; they could not see to close their molds without it. Flour is well enough in its way, but when a molder plasters a pound or two on each mold, when he could do as well without it, it is willful waste. It seems strange to me sometimes to see old country molders throwing flour over their molds. I don't think they ever saw it done there; at least I never did; but they have seen other molders do it here, and they think that as they are in Rome they must do as the Romans do; but it is all a habit, and it ought to be stopped.

There is another instance: A molder has got a piece to make in green sand; he has a helper or laborer with him to shovel sand, pick up gaggers, clay-wash them, etc., and consequently has lots of time to mix clay-wash. But no, he lets it go till the last minute, when it is wanted, and then he runs for a shovelful of flour, and puts that in the clay-wash pot, and calls it clay-wash; it answers its purpose well enough, but it is too expensive when there is plenty of clay. If the man had to get an order for flour, that would be stopped too.

The other day I saw a molder (after sifting sand on his pattern) throw a lot of flour on it. I asked him what it was for, and he told me that it was to throw a light to set the gaggers by; that was a new wrinkle to me, but I did not see that there was any gain in it.

Now I would like to say a word to foremen and proprietors. When I go into a foundry I generally look around to see something new; sometimes I do, and sometimes I don't; but one thing I always see, and that is the great waste at the tumbling barrels. They need to be watched every day, as the staves wear out and the iron runs through, and then it is wheeled to the dump. It is surprising, the amount of metal wasted in this way. It has not been long since I went into the mill-room and put about half a shovelful of the stuff that came through the mill in a quarter-inch riddle, took it to the bosh and washed it out, and there were about seven pounds of iron left in the riddle.

A good many foundrymen do not like to put the "shot" in the cupola, because it lies so close that the heat cannot get through it well, and has a tendency to bung up the cupola; but a very good way to do with it is, when the pigs are made, to take spare

iron, put as much of it in each pig as you think well, and the big pigs will eat up all the little ones.

Another good way is to take a walk to the dump now and then, and see what is wheeled out. After a shower of rain you will be able to pick out lots of iron, nails, spikes, gaggers, etc., and if you don't find some of your iron flasks you will be doing well.

The other day I went out and saw a lot of stuff that had come from the grinding room; there was about a small wheelbarrow full, and it looked as if there might be some iron in it, so I had it riddled, and there were seventy-five pounds of iron.

Cleveland, Ohio. THOS. WATHEY.

How He Cut His Finger Off.

Editor American Machinist:

The singular accident related in the AMERICAN MACHINIST, September 18, reminds me of one which I witnessed some ten years ago Its similarity consists in the unaccountable manner in which the victim put his finger where it had no business to be. It may be well to say here that this man had not a particle of humor in his disposition. He was no joker. He never cracked a joke himself, or was known to indicate in any manner any perception of a joke that any one else perpetrated. He was exceedingly taciturn, not ill-natured, however, but always attending to his own business, and oblivious to everything which did not concern him. This trait made his conduct on this occasion the more strange.

His business was packing mowing machines, and in the harvest season he was accustomed to go into the field as an expert with harvesting machines. One day he suddenly left his work, went down a flight of stairs, and looking neither to the right nor left, walked like a somnambulist through a room 500 feet long, thronged with busy workmen, turned, and crossed through a sheltered archway to another building, went straight through the room to where a grain-binder was running on trial, and, without pausing a moment, put the index finger of his right hand out immediately on a certain part of the machine, and as quick as it was laid there the binder needle came down upon it, and cut it off between the first and second joint. It just hung by the skin. He pulled his hand back, clapped the other hand over it, and walked out as straight as he came in, without uttering a syllable, leaving the bystanders so paralyzed with amazement that it was as much as five minutes before one of them stirred, or could move his tongue enough to articulate, "Well! that is the doggonedest foolish trick I ever did see a man do." After a while some one had sense enough to trace him up, and found that he had gone, in his usual straightforward manner, to have his stump dressed by the surgeon, but no one could ever get a word out of him in explanation of his singular conduct. It seemed as though he was just fated to do it. TYRO.

Core-oven Carriage.

Editor American Machinist:

The accompanying illustrations represent different views of a core-oven carriage. Its usefulness will be apparent without much explanation. Fig. 1 represents an elevation; Fig. 2, a plan; Fig. 3, a cross section, and Figs. 4 and 5 show a single rack in detail. These racks are the most important parts of the carriage; some of them are 12 inches high, others 8 inches; they are interchangeable. They can be placed on the carriage either lengthways or crossways, to suit the core; when placed crossways their length is limited by the width of the oven door. They are very handy for loading or unloading; as soon as one rack is filled, another one can be placed on top of it, and so on until the carriage is loaded to its full capacity. The castings required for the carriage, except the wheels, never left the foundry; it did not require a machinist for fitting it up. One pattern only is needed for all the racks. For the convenience of the core maker, I made two racks with flat feet as shown at *a*, Fig. 4; they are handy for sliding them onto the carriage, sometimes enabling two men to place a core into the oven, which formerly required four or five men; and the two men can do it better than five. Those who have had experience in handling cores, and carrying them into the oven, will readily see the usefulness of this arrangement. We have a large oven with suitable carriage, but it requires a great deal of coal; and at times, when there are not enough cores to fill it, the carriage here shown comes in very handy, for which the small oven can be used, and saves coal, time, hard work, and the cores can always be made to dry in time. I have known an order for two 6-inch columns 18 feet long to come in the foundry at 10 o'clock in the morning, and at 3 o'clock in the afternoon the columns were cast. Our small oven is in use from Monday morning until Saturday night; and in it, all the ladles, large and small, from a hand-ladle to a two-ton ladle, are dried, besides all the small cores needed during the day and night. The carriage paid for itself in a month by saving coal and hard labor. It is not patented. Any one can make it and use it.

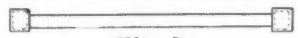


Fig. 5.

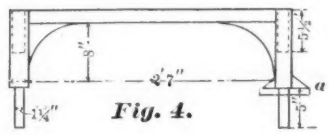


Fig. 4.

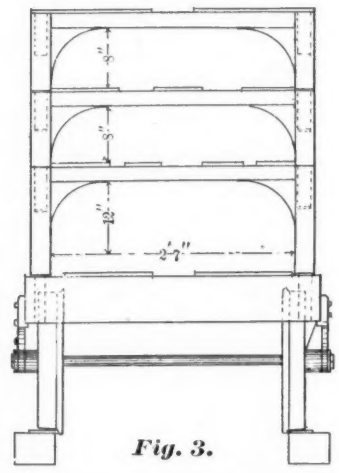


Fig. 3.

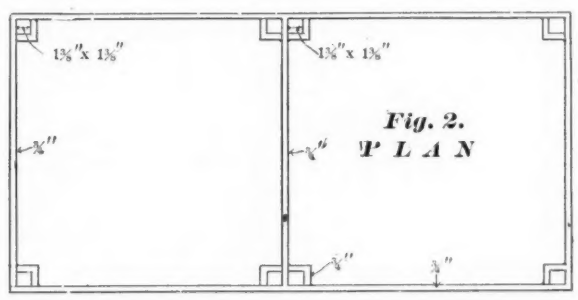


Fig. 2.
PLAN

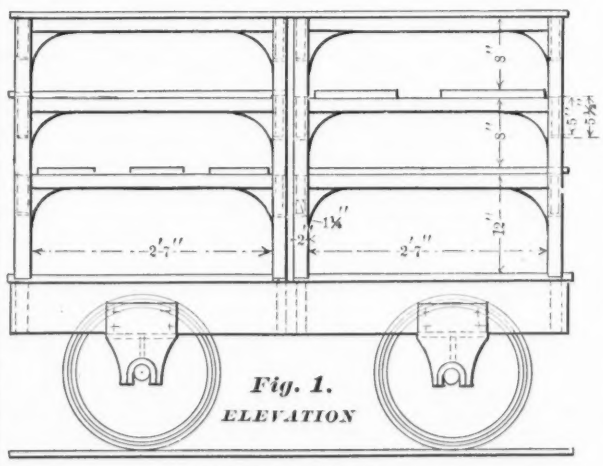


Fig. 1.
ELEVATION

CORE-OVEN CARRIAGE.

The Divining Rod.

Editor American Machinist:

As our friend W. H. Booth desires more light on the use of the divining rod, I give some facts that came under my observation in sixty one or two.

Wishing to get water near his barn, my father began digging a well; when a few feet down, a neighbor who could locate water with a forked twig, was consulted as to the probability of finding water in that location.

A forked twig was cut from an apple tree, and grasping a fork of the twig firmly in each hand, the backs of the hands being downward, the free end of the twig pointing upward, walking slowly over the ground, as he advanced to a point over the water-course, the free end of the twig would begin to incline in the direction of the water, and when he stood directly over the water, the end of the twig pointed directly downwards; as he proceeded, the twig would continue its inclination toward the water, until finally the attraction would be lost.

Turning about and walking over the ground again the same results were shown. This water-course was traced for some distance.

The first well was abandoned, and another dug, and water was found as located. If the forks of the twig can be held tightly enough, the free end, as it travels through the arc of 180 degrees, will produce a torsion that will be quite perceptible in the forks of the twig.

Until within a few years, there lived in Lancaster, Mass., a man who made it a part of his business to locate water for parties wishing to get water from wells. An uncle of mine locates water-courses, and his daughter also possesses the same gift, if I may so term it.

That there are persons able to locate water by the aid of a forked twig is a fact beyond dispute, and I should like to see a true explanation given. JOHN BARNARD.

Atlanta, Ga.

Proving Square Root.

Editor American Machinist:

In your issue of Sept. 18th, J. G. Aldrich gives a rule for proving square root; the rule is simply an extending of the old principle of casting out nines, which I have always considered far from a perfect test, my reason being, one cannot by this rule discover a mistake of 9, and one is certainly just as liable to make a mistake of 9 as of any other number, and even if not, I claim that any rule in arithmetic that is not universal should be barred; this is, in fact, an attempt to find a "royal road," or a short cut, where there is none to be found. For example, I have to find the root of 483,025, and bring 695 as my answer; then I apply the rule given, viz.: "Divide the sum of the digits of the root by 9, square the remainder, and divide this by 9. The last remainder should equal the remainder obtained by dividing the sum of the digits of the square by 9."

Root 695, sum of the digits, $20 \div 9 = 2$, with 2 remainder, $2^2 = 4 \div 9 = 0$, remainder, 4; then taking the square 483,025, sum, $22 \div 9 = 2$, remainder 4, correct!

Then I take the number 483,115, or 483,205, and making a mistake, still bring the root 695, which, by the rule given, I prove correct, also! and yet there is an error; and I might go on multiplying examples, showing cases where there would be an error, either in the square or the root, or both, and if the sum total of the digits in either case should be the same as if correct, or if there were a difference of 9 or a multiple of 9, then I, depending on this rule, should consider myself right, and yet be wrong.

Therefore I conclude that there is no safe proof but the old one of inverting the sum, and working back, squaring the root, and thus finding if the result is correct.

Chicago. P. S. DINGEY.

In 1889 the number of buildings put up in New York was, as per reports, 6,722. In Philadelphia the number was 11,965. The total cost of buildings in New York was nearly three times what it was in Philadelphia. The reason for this lies in the fact that in Philadelphia a large proportion of the buildings have been built by mechanics, and will be occupied by them and their families alone, while in New York the buildings fo habitation are modern rookeries, where hundreds of people are brought together in a contact that is everything but desirable. Philadelphia is way ahead in this respect.

Sketches of an Apprenticeship.

BY W. S. ROGERS.

IV.

One thing "the old man" did for his apprentices, that I have never seen in vogue elsewhere, was to give each one a half-holiday once a month, to visit the other shops in town, and add to his store of information and see how other people did things. Some of the boys used to go fishing at such times, and give the boss a vague account of their supposed visit, but the greater number enjoyed their half-day to the fullest extent, and many were the handy kinks we picked up and many the things we learned how not to do.

It was also the implanting of a habit that has become so strong that to-day I cannot pass by a machine shop without going in.

I got an idea the first shop I visited. The cub there was up in many things; he could run the lathe, shaper or drill, and I felt small during the two hours I spent in his shop. He had to drill a ¾-inch hole, so taking the ⅝-inch flat drill, which, by the way, was the only one in sight, to the blacksmith, he told him to "stove" it up to ¾ inch, then he ground it. Oh, my, but didn't I feel my lack of knowledge as he gracefully swung himself around that grindstone. After he had the ¾-inch hole drilled, one of the men gave him another piece of work to have ⅝-inch holes drilled in it. Did he get a ⅝-inch drill? No, indeed, he just took that ¾-inch one out to the blacksmith, and had it drawn down to ⅝, and drilled his holes.

I did not stop longer to see if he could convert it into a planer or lathe tool, but I do recollect seeing him toss it behind the drill press as I was going out.

Next morning I gave the old man a glowing account, but didn't tell him the drill kink. I would bring that out later when I got promoted to the drill press. Well, the time came, after patient waiting, and I worked my kink. I had been drilling a ⅝-inch hole, and the foreman told me to drill a ¾-inch hole in some work. Now was my time to illustrate to that aristocratic chap in the tool-room my independence. So the blacksmith stove it up, and I ground that drill with the same flourish the other fellow did. Then I made the hole and measured it. Well, it was an inch hole, and made with a ¾-inch drill. Great discovery. Almost bursting with importance, I sought the foreman and explained it. He calmly called me "a ¾-inch blockhead," as he threw the piece of iron in the junk pile, and taking me to the tool-room gave me a lasting lesson in drill grinding, while that tool-room aristocrat of a jour. looked whole volumes of sarcasm.

That evening at quitting time the old man quietly asked me where I first learned to grind drills, and I told him. Then he drew the moral of the lesson: "My boy, never try to do a thing just like some others, unless you know why they did it and how. Don't try imitation without a complete understanding. There are many people trying to build 36-inch lathes just because the firm on the next block is doing seemingly well at it, without the slightest idea of the how and wherefore of it, and they are always wondering why they don't succeed." In my travels I have had reason to remember the old man's remarks.

The report is that two or three oil companies have combined, moved to Toledo, and propose to establish a company in opposition to the "Standard." This makes nice talk, but what it really means is that the Standard will be strengthened to the extent of engulfing the new enterprise.

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A Lack of Skilled Mechanics.

It is a fact that in some of the important mechanical industries of the country there is lack of skilled workmen. The best evidence in the world of this is that in the machine business, for example, some shops have been running for months without a full supply of men, notwithstanding efforts to procure them. This is equally true in other mechanical lines of business. We mention only the machine business, because that will suffice for an example. There are enough men in the country for the work to be done; probably, as some argue, the number is too great; that is, there are probably more men in the country to-day than could, by any possibility, find work at wages upon which they could decently live and support families. But they are not properly divided up amongst the industries. In those branches where little skill is required there are, generally speaking, more applicants than there are jobs. This is made apparent every day. It is something the most unobserving can see. One reason for this is the efforts that have been made to secure immigration. Then, men, as mere workmen, can get along with little capital in the way of preparation, hence the tendency to over-crowding, just as there is an over-abundance of small stores that require but little capital to stock.

Then in the so-termed genteel occupations there is more than abundance of labor. A man who advertises for a salesman is likely to be confused by the number of applicants, or he can find a townful of boys to learn some genteel business where the future prospects are compassed by about eight dollars a week.

It is in those trades where the demand is for a combination of work and skill—knowledge—that the scarcity is felt. There are too few who are skilled in these trades—too few who are skilled mechanics in the proper sense of the word. The evidence of this is not in the fact that manufacturers are obliged to make an effort to find such men, but that they do not find them after the effort.

Various reasons are assigned—generally according to the bias of the individual—for this. It is common to put the blame on trades unions. And there may be instances where this is true. But we think the fault is not principally here. In fact, we think the objection of trades unions to the taking of apprentices is scarcely operative except in instances where there has been labor trouble, and growing out of this there has been an intention on one side to immeasurably increase the number of apprentices, with a view to obtaining an advantage, and on the other side an intention to restrict the number, with a like object. However this may be, it does not apply to the machinist trade, in any appreciable degree, at least. On the other hand, it seems to be a fact that cannot be gainsaid that in the trades where it takes some years to turn out journeymen few apprentices are taken, and this is the principal reason why the supply of journeymen is short. Why this is so is that it is generally believed that there is nothing made on the work of apprentices, or at least that what little is made is more than offset by the trouble involved. And if the reckoning is made in dollars and cents—and for the time being—this is probably true, yet in any machine shop there is, at least, no occasion to lose money on apprentices.

It has been the practice in this country for some years to run large works mainly with men and boys who never expect to do but one kind of work, and, of course, mechanics are not turned out of such shops. But we are getting more—a good deal more—into kinds of work that are not turned out by the thousand pieces. Heavy machinery for ice-making and refrigerating, big guns and large tools for making them, large engines for war vessels, and the vessels themselves; work of this kind has increased enormously by comparison, and the doing of such work calls for skilled mechanics—for men who do not come up from the experience gained by drilling certain sized holes in certain pieces for ten years, or equivalent operations. It requires the experience gained in the machine shop, the foundry, the boiler shop and the shipyard; men who have learned trades and know the correlation of the different parts of machines and machinery; and these are the men it is found are scarce. It could not be otherwise.

The idea that boys can be turned out of schools, ready to do the work required in the big machine shops growing up in this country is fallacious. In the first place boys do not graduate from technical schools to become mechanics, and even if they did they still have their trades to learn, very much as if they had never been to school; and in the instance of manual training schools the case is not materially different. Manual training schools are advantageous in a degree. If properly managed they give a boy a certain start in learning a trade, and they may be of even more service to boys who propose, as men, to stick to—turning bolts, for instance. But these are not the men that are lacking now. As we said before, mechanics are wanted, and the only satisfactory way to remedy this is one that will require time. The shops must make more mechanics. There is not much money in it, except in prospective, but in the end it will pay, and it will be a good thing for the country. We shall then soon cease to hear that we have to look to foreign countries for a supply of skilled mechanics.

The members of the Farmers' Alliance in the cotton growing States are impressed with the idea that they do not get their share of the profit in the cotton crop of the country, and to the end of a more equal division of profits, have determined to store their crop until more (to them) satisfactory prices obtain. The farmers who raise cotton, or many of them, borrow money on the strength of the prospective crop, hence the bankers and brokers who have advanced money are in tribulation. It is said that European capitalists are willing to advance the farmers money on their cotton thus stored, and that if this fails then the home broker and merchant must do the best they can; the gin will break down, or some other accident will occur to prevent getting the crop ready for the market. The farmers reason that they have heretofore been unmercifully crushed by the brokers and merchants, and that they are fighting in self-defense. There is probably much truth in what they say. It is the outcome of an unsatisfactory way of doing business: viz., selling something not in existence; a sort of Wall street operation.

Recently we noticed the fact that the steamship Teutonic beat the New York by an hour or two in the transatlantic voyage. Now the New York has beat the Teutonic by fourteen minutes. There is something a trifle suspicious in these close margins. To those who realize, in a small degree, what a difference of only fourteen minutes in a race of 3,000 miles between two great steamships means, the margin appears mighty small. It is probably all right, but it seems to indicate that great strides have been made in the science of steam navigation, as compared with the use of steam on land. Imagine two locomotives, with their respective trains, making a forced trip of 3,000 miles, and coming in within a quarter of an hour of each other.

The Government of the United States, personified for the occasion by Secretary Windom, has come up nobly to the help of Wall street speculators. It may be best that this is so, but if it is, it is not because these speculators are deserving of any consideration. It is because by helping them out their operations may be rendered innocuous so far as the rest of the country is concerned. These speculators, who were engaged in cornering crops, and other similar harmful operations, could well be left to their fate, were it not that their downfall would drag innocent parties down with them.

These are times of great undertakings. A bridge across the Hudson River, at New York, and a tunnel under New York Bay, are among the greatest proposed American schemes. But these are put quite in the shade by the proposed tunnel under the English Channel, connecting England and France. It is said that, so far as investigations have gone, they demonstrate the entire feasibility of the plan.

Literary Notes.

PRACTICAL TREATISE ON INJECTORS AS FEEDERS OF STEAM BOILERS. For the use of Master Mechanics in charge of Locomotive, Marine and Stationary Boilers. With numerous cuts. By George N. Nissenson, Engineer.

This work is intended for those who use the injectors daily, and not for those who manufacture them. In consequence of this, the theory of the apparatus and its principles are gone into only so far as they are apt to facilitate the practice, and can be made comprehensive enough, even to that man who hardly has any opportunity for theoretical studies. The main object of the book is to explain to the practical engineer the rudimentary principles of the injector, so that its action will be understood, and enable him to make it work in case it fails to do so. The principle of the injector is very plainly stated, although great exactness in the calculations which are based on the principles is not aimed at.

Besides the general principles explained, and which are common to all injectors, the book contains the description and the directions for operating all the most approved patterns of injectors now in use.

The whole makes up very interesting reading for those who have charge of injectors, and no one, who is not already familiar with the different forms of injectors, as described in various trade catalogues, and the action of the injector, can fail to be benefited by a careful perusal of the book. Even the fact of having the descriptions of so many different injectors in one book should make valuable to all interested in injectors. The book is published by the author, 160 East 109th street, New York. Price, 50 cents.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(387) L. E. F., Lima, Ohio, writes: I wish to make cast-iron balls, to weigh 10 pounds each. The shell is to be ¼ inch thick. What should be the outside diameter of each ball? You need not pay any attention to the core holes in the shell, as these will be plugged. The balls will be made of common gray iron, and a few ounces either way will not make any difference. *A.*—Outside diameter, $5\frac{7}{8}$ inches.

(388) W. C. N., Dundas, Canada, asks: Can you give me any information of applying silicate soda or soluble glass to a stone building which is becoming disintegrated from some cause or another? We have applied cold as in ordinary painting, but it runs off, and is consequently useless. *A.*—We do not like to advise you in this matter, as we have had no experience in this line. But if any of our readers will furnish the information we shall take pleasure in publishing it.

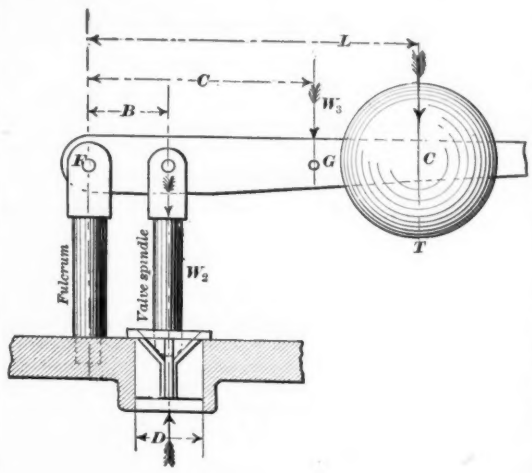
(389) W. L. S., Dallas, Tex., writes: 1. Please inform me where, and at what price, I can get a book treating on the gas engine and pumps. *A.*—Quite a number of books relating to gas engines have been published. In some of the books the subject is treated from a practical standpoint, and in others from a theoretical one. Since we do not know how far you have advanced in the elementary studies, we may disappoint you in recommending any particular book. As to pumps, probably the "Practical Hand Book on Pump Construction," by P. R. Björling, price $1.50, may suit you. In any event, it is always advantageous to have more than one book treating on a particular subject; we would therefore advise you to get a catalogue from a dealer in scientific works and make your own selections. 2. Will the quality of the gas affect the running of the engine? *A.*—Yes. 3. Some days the engine

runs well, and again it will barely start. What is the cause of this, and how can I remedy it? *A.*—A little reflection will convince you that with so many different gas engines in the market, it is impossible for us to locate the cause of the trouble unless we know to what kind of engine you refer. Your question is very indefinite.

(390) X. Y., New York, asks: How is it that in a compound engine of the Corliss type, where the outside laps are two distinct features, that one eccentric controls them both? For instance, in an engine with ordinary slide valves the throw of the eccentric is equal to twice the lap of the valve plus the width of the steam port, and if the valves for two cylinders are not alike, one eccentric cannot move them correctly. *A.*—In a Corliss engine of the compound type the travel of the valves is regulated by the length of the arms which transmit motion to the valves. In many engines of this type the arms which transmit motion to the high-pressure valve are shorter than the arms on the low-pressure valves, and in this manner one eccentric can transmit the required motion to the valves in both cylinders. In the Corliss engine the throw of the eccentric is not necessarily twice the width of the steam port and the lap; indeed, in many cases it is greater. 2. The diameter of the low-pressure cylinder in a small compound engine is 2½ inches; what should be the diameter of the high-pressure cylinders? *A.*—For a steam pressure of about 80 pounds per square inch we should make the diameter of the high-pressure cylinder 1¼ inches.

(391) McB., Philadelphia, Pa., writes: Do you know of any contrivance in steam drums to prevent water from coming over into the cylinders of engines? We know of separators and traps to catch the water after it leaves the boiler, so as to prevent it from going to the cylinders. But what we desire to know is as follows: We have a very small boiler, and have no space for a larger one. It makes steam very fast; in fact, it can make as much steam as we can use, as it has the exhaust in the smoke-stack. And if we start at a pressure of say 70 pounds, with the engine running at a high rate of speed, the steam will run up to say 150 pounds, and we will have to open the fire-door to prevent the boiler from blowing off steam, as the safety valve is set at 150 pounds. If we open the throtle valve to increase the speed to 300 revolutions, the boiler primes and carries the water over to the cylinder. The exhaust steam creates a sufficient draught for making plenty of steam, but we are unable to prevent priming. The steam drum is 15 inches diameter and 12 inches high. Do you know of any baffle plate or other device to prevent the water from coming over with the steam? *A.*—If you had given us the size of engine and boiler, and the manner in which the steam pipe is connected to them, we would have been in a better position to advise you correctly. But, from what you have stated, it is evident that the draught is too strong, and to reduce it, we should advise you to increase the opening through which the exhaust steam passes into the stack. You should also increase the size of the steam pipe near the dome, so as to reduce the velocity of the steam as it flows out of the boiler, and cover the pipe well to prevent condensation. The steam pipe should extend horizontally as far as possible into the dome near the top. A cap should be put on the inner end of the pipe, and the latter should have several rows of small holes drilled along the entire length of its upper side; the aggregate area of these holes should be at least twice the area of the steam pipe. The steam pipe in the dome should also have one small hole near the point of exit for drainage. Increasing the size of the steam pipe will not only reduce the velocity of the steam as it flows out of the boiler, but it will also add to the capacity of the dome, all of which will tend to prevent priming. Of course, good judgment should be used in determining the size of steam pipe, as it will be disadvantageous to have it too large.

(392) Young Engineer, Chester, Pa., writes: I chanced to find in a back number of the AMERICAN MACHINIST, June 27th, 1885, questions given in the examination of stationary engineers. I have worked out Questions No. 47 and No. 48, and enclose the answers. Please let me know if I am right. If I am wrong, please correct, and give the proper way for solving the problems. Question 47 is as follows: What will be the weight, in pounds, for a ball for a 4-inch safety valve, the distance from the fulcrum to the center of the disk being four inches, and the weight of the lever 12½ pounds, and its center of gravity 20 inches, the weight being placed 20 inches from the center of the disk, and the pressure of the steam 50 pounds? Also the disk unconsidered? *A.*—Your answer is wrong; and judging by the manner in which you have worked out the example, we conclude that you are not thoroughly posted on the principles on which all these safety valve problems are based. Since questions of this kind are frequently given to stationary engineers, and since quite a number meet with difficulties in solving them, we shall endeavor once more to point out the elementary principles as clearly as possible, believing that, if these are throughly understood, the solutions of problems of this kind will appear to be very simple. In all ordinary safety valves of the kind here shown we have four parallel forces acting in vertical lines on the safety valve disk, namely the steam pressure acting on the disk; the weight T acting on the end of the lever; the weight of the lever acting in a vertical line through its center of gravity G; and the weight of the valve and spindle acting in a vertical line at a distance B from the fulcrum F. Again, it will be noticed that only one of these



forces acts upwards, namely the steam pressure on the disk; all the other forces act downwards. These forces act with a given leverage, and in order to determine what turning effect each force will have, we must take the leverage into account. To do so, we muliply the force by the distance from its line of action to the fulcrum. This product is called the *moment of the force about the point* (in this case about the point F), so that we may define the moment of a force about a point to be numerically equal to *the product of the force, and the perpendicular let fall from the point on its line of action.* For instance, the total pressure on the disk is equal to its area, which is 12.566 square inches multiplied by the pressure per square inch, which is here given as 50 pounds, hence we have $12.566 \times 50 = 628.3$ pounds, which is the force acting upwards; this force acts in a line 4 inches from the fulcrum, hence the moment of this force about the point F is $628.3 \times 4 = 2{,}513.2$ inch-pounds. The unit of moment depends on the units of force and distance; if the force is given in pounds, and the distance to the fulcrum in inches, we obtain inch-pounds; if, on the other hand, the distance is in feet, and the force in pounds, we obtain foot-pounds. We may take the distance in inches or in feet, the final result will be the same; but to avoid confusion it is always best, in safety valve problems, to take the distance in inches, and the force in pounds. Now, the foregoing rule for finding the moment of the force on the disk about the fulcrum F may be given in a symbolic expression; and indeed these symbolic expressions are of great advantage in computation, because they do not tax the memory so much as rules in the ordinary language, and they are read with far greater ease, and consequently mistakes are not so liable to occur. Let P denote the steam pressure in pounds per square inch on the disk; A, the area in square inches of the disk; and B, the distance in inches from the center of the disk to the fulcrum F. Then, from the foregoing, the moment of the force on the disk about the point F is

$$P \times A \times B = \text{moment.} \quad (1)$$

In a similar way we may give a symbolic expression of the moments of the other forces. For instance, to find the moment of the weight of the safety valve spindle and disk, we put W_2 for the sum of these weights, and B for the distance from line in which these weights act to the fulcrum F; hence $W_2 \times B = \text{moment of the weight } W_2$. (2) Again, let W_3 denote the weight in pounds of the safety valve lever; G, its center of gravity; and C, the distance in inches from the center of gravity G, to the fulcrum F. We have then for the moment of this force, $W_3 \times C = \text{moment of the weight } W_3$. (3) Lastly, let L denote the distance in inches from the fulcrum F to the center c of the ball, and T the weight in pounds of the ball; we have then,

$$T \times L = \text{moment of the weight } T. \quad (4)$$

All these moments are of course about the fulcrum F. Now, when the steam pressure is just sufficient to lift the valve, we have then a state of equilibrium, and in this state the sum of the moments acting upwards must be equal to the sum of the moments acting downwards. In our example we have only one moment acting upwards, namely $P \times A \times B$; all the other moments act downwards, and their sum is equal to

$$(W_2 \times B) + (W_3 \times C) + (T \times L).$$

From what has been said, we have in a state of equilibrium

$$P \times A \times B = (W_2 \times B) + (W_3 \times C) + (T \times L).$$

This gives us the relation of the moments, and with this symbolic expression we can easily work out any safety valve problem. To apply this to the example, it must be remembered that, according to the given conditions, the weight of the valve and spindle is not to be taken into consideration, consequently the moment $W_2 \times B$ must be thrown out of the formula; we have, therefore,

$$P \times A \times B = (W_3 \times C) + (T \times L). \quad (5)$$

Now, substituting for the symbols their values we have,

$$50 \times 12.566 \times 4'' = (12.5 \times 20'') + (T \times 20'')$$

which is equal to

$$2{,}513.2 = 250 + (T \times 20'') \quad (6)$$

In which T is an unknown quantity; that is, T is the weight required. To find T, we must put all the known quantities on one side of the equation, and the unknown on the other, and thus obtain

$$2{,}513.2 - 250 = T \times 20''. \quad (7)$$

It will be here noticed that, in transposing the moment 250, we have given it a minus sign; a little reflection will show that this is as it should be. To impress this change of sign on the memory, we will say that in transposing a quantity, its sign must always be changed from + to minus, or from — to +. In Equation 6, the quantity 250 had no sign, but under these circumstances a + sign is always understood, and in transposing we must affix the — sign. This rule always holds true in working out an equation. Now, performing the operation as indicated by the signs, we have

$$2{,}263 = T \times 20.$$

Consequently,

$$\frac{2{,}263}{20} = T = 113.15 \text{ pounds,}$$

which is the weight of the ball. 2. Question 48 reads: Under the same conditions, how far from the center of the disk should a 50 pound ball be placed? *A.*—Here again we use our symbolic expression or equation (5)

$$P \times A \times B = (W_3 \times C) + (T \times L).$$

Substituting for the symbols their values, we have,

$$50 \times 12.566 \times 4'' = (12.5 \times 20) + (50 \times L),$$

which is equal to

$$2{,}513.2 = 250 + (50 \times L).$$

$$2{,}513.2 - 250 = 50 \times L.$$

and

$$2{,}263 = 50 \times L.$$

hence

$$\frac{2{,}263}{50} = L = 45.26 \text{ inches.}$$

In a similar way any other safety valve problem can be solved, and if the principles here given are thoroughly understood, these solutions will lose all their difficulties, which are more imaginary than real.

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"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 53 East 10th st., New York.

MANUFACTURES

Indiana parties will build two saw-mills at Newport, Ark.

An ice factory will be erected this fall at Uniontown, Ala.

The Whiteman Paper Mills, Dansville, N. Y., are to be rebuilt.

It is rumored that a new cotton-mill will soon be erected at Millville, Mass.

A knitting and woolen-mill will probably be erected at Morristown, Tenn.

The Emerson Machine Company, at Granby, Conn., will double its capacity.

Reports state that the Aurora Cotton-mill, at Burlington, N. C., will be enlarged.

A wood pulp and paper-mill plant, to cost $100,000, is to be set up at Ashland, Wis.

It is reported that an 8,000-spindle cotton factory will be erected at Albertville, Ala.

At Albany, Ga., the erection of a cotton-mill by a $200,000 stock company is projected.

Work has commenced on the buildings for the electric plant at Wichita Falls, Texas.

Wilton, Iowa, has voted to expend $14,000 for water-works and an electric-light plant.

It is stated that the Roanoke Southern Railroad Co. will build car shops in Roanoke, Va.

It is stated that the Roanoke Southern Railroad Co. will build car shops in Roanoke, Va.

The American Bridge Works (Roanoke, Va.,) will erect an addition to its works, 75x100 feet.

The Eagle Iron Works (St. Louis, Mo.,) contemplate adding more machinery to their plant.

An ice factory will be erected by W. E. Worth & Co., of Wilmington, N. C., at Charlotte, N. C.

It is stated that the Wadesboro (N. C.) cotton-mill has purchased a site for its cotton factory.

The Vulcan Boiler Company, at Findlay, Ohio, has been incorporated, with a capital of $35,000.

A ten-ton cotton-seed-mill will be completed and in operation by October 1st, at Hempstead, Texas.

The Jackson Foundry Association will erect a new building for its iron foundry at Jackson, Tenn.

Overman & Schrader will enlarge their twine factory at Covington, Ky., and put in new machinery.

It is stated that an electric-light plant will be erected and water-works constructed at Stanley, Va.

A paper-mill, to cost $30,000, for the manufacture of straw paper will be erected at Oak Cliff, Dallas, Tex.

The Marble Falls Manufacturing Alliance will erect a cotton bagging factory at Marble Falls, Tex.

Boston parties have organized a $250,000 stock company, to erect a paper-mill at Fort Worth, Texas.

The Charleston Electric Light and Power Co. will probably erect a new electric light plant at Charleston, S. C.

The Woodcock Iron Works Company, of Auburn, N. Y., will, it is stated, move its iron works to Goshen, Va.

A five-ton per day ice factory will be established at Beeville, Texas, by the San Antonio Brewing Association.

The Louisiana Electric Light Company will enlarge and improve its electric light plant at New Orleans, La.

It is stated that James H. Nason, of Chelsea, Mass., contemplates building a woolen-mill at Clinton, Me.

The city of Hopkinsville, Ky., will erect an electric light plant and construct water-works after January 1, 1891.

J. H. Gill, of Raleigh, N. C., is investigating with a view to establishing foundry and machine shops at Glasgow, Va.

The Chattanooga (Tenn.) Machinery Co. is, it is reported, enlarging its machine works, and adding an iron foundry.

The Luray (Va.) Manufacturing Co. has been organized, with A. Broadus as president, and W. O. Yager, secretary.

The Delphos (Ohio) Electric Light and Power Company has increased its capital stock from $25,000 to $40,000.

A plant to combine a cotton-seed oil-mill, a soap factory, and acid phosphate works, will be erected at New Orleans, La.

The Oakland Woolen-mills, at Oakland, Md., will be rebuilt. The new structure will be 125x75 feet, and five stories high.

It is stated that an iron furnace will be built, and an iron foundry and machine shop established at Crawfish Springs, Ga.

The Cordis Cotton-mills, Millbury, Mass., are getting in an electric light plant, and will hereafter be lighted by electricity.

F. H. West is organizing a stock company in Milwaukee, to establish a plumbers' hardware factory in Bessemer, Ala.

The Graham Furnace Company, Graham, Va., is constructing an iron furnace, with a capacity of about 100 tons per day.

The St. Louis, Arkansas & Texas Railway (office, St. Louis, Mo.,) will erect machine shops and roundhouses in Commerce, Tex.

There is some talk of the Cooke County (Texas) Horticultural Society putting a canning factory in operation for next season.

J. J. Rowe has commenced laying the foundation for a new knitting-mill at Amsterdam, N. Y. About 100 hands will be employed.

The Pittsburgh Foundry and Machine Co. has been incorporated at Pittsburgh, Crawford County, Kansas. Capital stock, $50,000.

F. J. Sprague, E. H. Johnson, J. W. Wingate and others have organized the stock company to erect an ice factory at Winston, N. C.

The Greenville Ice and Storage Company has been organized, to erect an ice factory at Greenville, Ala. Capital stock, $14,000.

The city of Wetumpka, Ala., has, it is reported, contracted with a Chicago (Ill.) company, for the erection of an electric light plant.

The Morris Machine Works, at Baldwinsville, N. Y., are to erect the Sault Ste. Marie Canal Pumping Plant at Michigan for the government.

P. A. Brawner, Jr., and others have incorporated the Southern Malleable Iron Co., to erect a malleable iron plant at Chattanooga, Tenn.

The Chadwick Lead Works, of Boston, are to move their litharge plant to Salem, Mass.; it will be one of the most complete in the country.

The Coleman Rolling-mill Company, of South Pittsburg, Tenn., is to build a rolling-mill with a daily capacity of thirty tons of finished iron.

It is reported that the Lenone Manufacturing Company, of Sweetwater, Tenn., has purchased a site for the erection of a $100,000 cotton-mill.

Another large new industry will be started in Anniston, Ala., that of a car spring plant, secured through the efforts of Messrs. Ledbetter & Co.

The Chicago Safe and Lock Company has decided to remove its extensive plant to Waukegan, Ill., where new works will be erected, to cost $100,000.

Reports state that the erection of a cotton-flannel-mill is contemplated at Atlanta, Ga., and John M. Moore, 33 Peachtree street, Atlanta, is interested.

The Stanberry Light and Power Company has been formed at Stanberry, Mo.; capital, $7,000; incorporators, F. A. Weimer, J. S. Lindley and D. F. Hill.

The J. N. Sarborough Manufacturing Co., of Americus, Ga., will be organized, with a capital stock of $100,000 to manufacture automatic car brakes.

The Premier Steel Company, composed of capitalists of New Albany, Ind., have purchased the entire plant of the Indianapolis Rolling-mill for $132,000.

The Frederick City Manufacturing and Development Co. is negotiating with a Pennsylvania company for the location of an iron foundry in Frederick, Md.

W. F. Summerson, of Staunton, has received the contract from the Clifton Forge Woolen-mills Company to erect the woolen-mill at Clifton Forge, Va.

The Detroit Plumbers' Supply Company has been organized at Detroit, Mich., with a capital of $20,000, to manufacture plumbers' goods and sanitary specialties.

The Glendale Cotton-mill Company, Spartanburg, S. C., is working at its new mill. The foundation is about completed, and the brick work will now go on rapidly.

The American Fiber Co. has been incorporated by C. H. Adams, J. J. Barr and others, to manufacture defibrating machinery at New Orleans, La. Capital, $300,000.

A large plant for the manufacture of steel for edge tools is shortly to be removed from Canada to Atlanta, Ga. The process employed will be an entirely new one.

The Electric Construction and Repair Company, capital, $50,000, has been incorporated at Chicago, Ill.; incorporators, C. M. Barclay, W. A. Kreidler and S. D. Pickett.

When the Lawrence Iron and Steel Company, of Ironton, O., is removed to Glasgow, Va., there will be some extensive improvements and additions made to the plant.

The establishment of an electric light plant, water-works, cotton-seed oil-mill and canning factory is contemplated at Comanche, Tex. J. F. McCarty is interested.

It is stated that the Nashville, Chattanooga & St. Louis Railroad Company, and the Alabama Mineral Railroad, will erect joint machine shops and roundhouses in Attalla, Ala.

Sterling Elliott, Newton, Mass., issues a card giving revised prices of his cutting-off tool. The reason for the revision is a novel one, which we shall not try to explain.

S. T. Jones, J. L. McComas, E. H. Sincell and others, have incorporated the Oakland Electric Light and Power Company, at Oakland, Md., with a capital stock of $7,000.

A company, composed of L. M. Dunn, R. Van Antwerp, R. R. Flanagan, A. J. Price and W. C. Burns, with $15,000 capital, will furnish electric light for Hinton, W. Va.

The Superior Horse Nail Company, of Chicago, have concluded to move their factory to Kankakee, Ill., and to materially increase their capacity by the addition of new machinery.

The Brown & Sharpe Mfg. Co. (Providence, R. I.,) has issued a two-leaf circular of the No. 2 universal grinding machine, illustrated and described in our issue of September 18.

It is reported that the erection of an open hearth steel plant and a bridge shop is contemplated in the near future by the Muskegon Iron and Steel Company, of Muskegon, Mich.

J. W. Smith, John M. Cantrell and others, have formed a stock company for the purpose of incorporating the Ajax Milling Company, with a capital of $50,000, at Gallatin, Tenn.

It is stated that Massachusetts and New Jersey capitalists have made a proposition to erect $500,000 car works in Dallas, Tex. George Anderson, of Galveston, can give information.

R. C. Vandegrift & Son, of Charlottesville, Va., will build a woolen-mill at that place. It will be 100x50 feet, two stories, with a tower 12x12 feet inside, and an engine-room 20x24 feet.

The Henderson Steel and Manufacturing Co., of Birmingham, Ala., has increased its capital stock $100,000, will enlarge its works and erect two 10-ton iron furnaces and a blooming train.

The Sheffield Boiler, Foundry and Iron Works at Sheffield, Ala., has let the contract for the erection of five buildings of iron and brick, into which the most modern machinery is to be placed.

T. H. Shelly, A. G. Williams, W. Wood and others have incorporated the T. H. Shelly Manufacturing Company, to tan leather, manufacture shoes, etc., at Gainesville, Ga. The capital stock is $20,000.

The Vulcan Boiler Works, Toledo, Ohio, have been incorporated, with a capital stock of $35,000. The new company will manufacture boilers on a large scale, under patents owned by J. J. Cronin.

M. M. Rogers, L. L. Powell, W. S. Gooch and others will, it is reported, organize a stock company, to erect a plant at Roanoke, Va., for the manufacture of the Woolly patent electric motor.

A company has been organized by J. M. Hunt and others to establish a factory at Macon, Ga., for the manufacture of a mower, recently patented by Mr. Hunt. The company have a capital stock of $50,000.

Albert Baldwin, Sr., Albert Baldwin, Jr., and W. Y. West have incorporated the New Orleans (La.) Agricultural Works, Limited, to manufacture agricultural implements, etc. The capital stock is $30,000.

The Long Island Cotton-mill has been incorporated by G. H. Brown and J. S. Ramsay, of Scottsville, N. C., and James Brown, to operate a cotton factory at Monbo, N. C. The capital stock is $35,000.

The Dominion Railway Supply Company has been incorporated, with a capital stock of $100,000, and will erect works, at Windsor, Ont., for the manufacture of railway appliances, machinery, tools and supplies.

The emery wheels made by the Norton Emery Wheel Company, Worcester, Mass., are recommended for use on the Brown & Sharpe Mfg. Co.'s grinding machines in a pamphlet issued by the last-named company.

It is reported that a company is being organized by capitalists interested in the Norfolk & Western Railroad, to build a basic steel plant at Salem, Va. This is in addition to the McCarty steel plant to be built in this place.

The Carolina Machinery Co. has been organized, with A. B. Williams, president; M. H. Russell, general manager, and W. S. Cook, secretary, to establish a machine shop at Fayetteville, N. C. The capital stock is $20,000.

The Mason Milling, Ginning and Manufacturing Company has been organized, with a capital of $30,000. They will operate an ice factory and may rebuild the Koock flour-mill and cotton gin, recently burned at Mason, Tex.

The Whiteside & Fuller Electric Manufacturing Company has been incorporated, at Chicago, Ill., to manufacture electrical machinery and appliances; capital stock, $100,000; incorporators, W. H. Whiteside, W. H. Pettibone, W. D. Carlile.

The Cedar Point Foundry, Port Henry, N. Y., are putting new tools in machine shop, and otherwise preparing for increased business. The business of the firm is largely the making of yacht engines, simple, compound and triple expansion.

A. K. Rarig & Co., Columbus, O., will erect boiler and machine shops at Buena Vista, Va. The foundry shop will be 125x200; pattern shop, 50x200; smith shop, 50x100; machine shop, 125x300; a boiler room 125x200, and engine room 40x70 feet.

The Stark Car Motor and Manufacturing Co., of Chicago, has been incorporated, for the purpose of manufacturing appliances for transportation, by J. H. Raymond, O. R. Barnett and P. R. Shumway. The company has a capital stock of $25,000.

It is stated that Messrs. Schaw, Ingraham, Batcher & Co., of Sacramento, Cal., will establish works for the manufacture of plate-iron pipe for conveying water. They recently received a contract for supplying 2½ miles of 22-inch pipe.

It is reported that W. H. Hurst, of Rahway, N. J., will start a new factory at Yardly, Bucks County, Penn., for the manufacture of rugs. He has leased a suitable building, it is said, and will remove his plant and begin operations in a few weeks.

The Mansfield Brass Works has made a proposition to the people of Bellaire, Ohio, that it will remove its plant to that town if the people will give it a bonus of $5,000, and take half of its stock, amounting to $40,000. The offer has not been accepted.

The Humbert Nut Lock Company has been incorporated at Basic City, Va., with T. S. Doyle, of Staunton, Va., as president; J. F. Christian, of Roanoke, Va., vice-president, and Taylor Bissell, of Staunton, secretary, to manufacture nut locks. The capital stock is $10,000.

The foundations are now being laid for the car wheel works at Jefferson, Tex., and the machinery will be set up next month. There has already been invested in the blast furnace about $167,000, and the plant will soon become the chief factor in utilizing the iron of that region.

R. A. Bret, of Chicago, has been in consultation with the leading business men and manufacturers of Evansville, Ind., with the object of establishing a steel car plant at that place. It is said that his plans have been favorably received, and that there is little doubt about his success.

The Brown & Sharpe Manufacturing Company will make an extensive exhibition at the fair of the Massachusetts Charitable Mechanic Association (Boston, Mass.,) from October 1 to November 30. This they announce in a neat little circular, inviting their friends to visit them.

The Rome (Ga.) Rolling-mill has been purchased for $38,500, by B. A. Jenkins, of Knoxville, Tenn., J. J. Reed, D. R. Benynon and others, who have incorporated the Rome Cotton Tie Manufacturing Company to operate the same. The capital is $50,000, and the plant will be enlarged.

The buildings at the Hercules Iron Works, at Aurora, Ill., are finished. The company will soon have the machinery in place. The buildings are composed of brick and stone, and comprise a machine shop, foundry and office. The products of these works are steam engines, ice machines, etc.

The Ohio Manufacturing and Investment Company has been organized, at Florence, Ala., with a capital of $1,000,000. The officers elected are A. W. Stockwell, president; E. R. Carlisle, vice-president; J. R. Sheridan, secretary and treasurer. The object of the company is the general development of the industrial enterprises of Florence.

The Bonzano Metallic Railroad Tie Co., of New Jersey, has been chartered, to manufacture steel railroad ties, under the patents of Assistant General Superintendent M. F. Bonzano, of the Philadelphia & Reading road. The company has a capital stock of $1,000,000. Other prominent railway and business men are interested in the new concern.

The Crane Iron Company, of Catasauqua, Pa., is building a modern 18x75 blast furnace, equipped with firebrick stoves. The company's old B furnace is being torn down to make room for the new plant. Frank C. Roberts, C. E., of Philadelphia and Pittsburgh, the engineer of the company, will prepare all plans and specifications for the work.

Savannah, Ga., has the prospect of another cotton-mill. It is proposed to raise the necessary $500,000, and to locate the factory at Southover Junction. That location has railroad communication with all the wharves of the city, and also with all the interior towns of importance. It is expected that the greater part of the $500,000 will be raised in the North.

It is reported that there is little doubt that the Baltic Woolen-mill property in Sprague, Conn., will be bought by the Coates Thread Company, and that a large factory, to employ 1,000 persons, will be erected on the site of the cotton-mill burned three years ago. The town of Sprague has voted to abate for five years taxes on all improvements on the Baltic mill property, if parties would buy and develop it.

The Brilliant Steel and Iron Company, of Wheeling, W. Va., was incorporated under the laws of West Virginia, last week, for the purpose of operating the old Spaulding mill at Brilliant, Ohio. The incorporators are the gentlemen who purchased the mill at sheriff's sale, and it is understood that they will not only make nails, as the old owners did, but will build a steel plate and sheet mill in connection with it.

There is water-works agitation in Wenham, Mass.; Madison, Ga.; Lebanon, Ill.; Santa Ana, Cal.; Carlville, Ill.; Lancaster, Pa.; Mt. Sterling, Ky.; Eustis, Fla.; Greenville, S. C.; Chillicothe, O.; Atkinson, Neb.; Morristown, Tenn.; Burlington, Col.; Lowell, Mass.; Lynn, Mass.; Kalkaska, Mich.; Quincy, Ill.; Arkadelphia, Ark.; Rutherford, N. J.; Pittsburgh, Pa.; Oxford, N. C.; Jersey City, N. J.; Winchester, Tenn.; Hempstead, N. Y.

The San Francisco Bridge Co. has been awarded contracts for the building of three bridges on the Canadian branch of the Great Northern over the Skagit, Stillaguamish and Snohomish Rivers. The contracts are conditioned for the completion of the bridges by December 1st. They are to be truss structures, and the total cost will be nearly $150,000. The Snohomish bridge will be 1,700 feet, the Stillaguamish 400 feet and the Skagit 600 feet long.

Workmen have just begun an excavation for the foundation of an addition which is to be built to No. 3 mill of the Pepperell Manufacturing Company's plant, Biddeford, Me. The mill will be increased in width by about twenty feet, bringing the wall of the mill out flush with the towers. The extra space obtained will be used for more looms. There are now nearly 3,000 looms in operation. The goods turned out by this mill have the highest standing.

The Walker Manufacturing Co. (Cleveland, Ohio,) is adding to its already extensive plant a machine shop 250x400 feet, and a foundry 200x300 feet. They have at present two foundries, but one of them will be converted into a machine shop as soon as the new buildings are completed. This company, in addition to other lines of work, makes a specialty of equipping cable roads, and are now putting in the machinery for the elevated cable roads of Cleveland. Recently the company shipped an 84-ton spur gear to Australia, and at present are making a 60-ton pulley, 24 feet diameter, 72-inch face.

The Newport Iron and Steel Works, of Newport, Ky., have passed into the hands of the Ironton Steel Company, Ironton, Ohio, the purchase price being $100,000. It is proposed by the purchasers to build on the site of the present mill a steel plant of great size, and plans are already being drawn up with this end in view. Two hundred and fifty thousand dollars will be expended in enlarging and improving the plant. The 18-inch bar-mill, the plate-mill and muck-mill and the furnaces belonging to them are now being overhauled, and, where necessary, new machinery will be added. A large engine will be placed in the south end of the old building to run the muck-mill. The capacity of the blast furnace will be increased from 65 tons, its present capacity, to 150 tons. A large foundry and machine shop will be built.

Variable Exhaust.

Considerable ingenuity has been expended in bringing out a device by which the draught of a locomotive can be varied at will. For this purpose we have had the variable exhaust nozzles, that is, those whose area or shape could be changed, thereby intensifying or diminishing the effect of the outgoing steam. These devices have not worked satisfactorily, chiefly for the reason that the mechanism becomes choked, and is rendered useless. Another method for producing the desired effect is to leave the exhaust nozzle fixed, and change the force of the draught by admitting air at the base of the smoke-stack; in cases of this kind the admission of air is controlled from the cab, and is entirely cut off when the maximum draught is required. The Luttgens regulator, illustrated in our issue of May 22, current volume, is a good example of the kind. Of course, devices of this kind as well as the variable exhaust nozzle, have for

their object the change of the intensity of the exhaust steam, so that the draught may be reduced. But the importance of the action of a mild exhaust on the fire is sometimes not as much appreciated as it deserves. It seems to us that the recent trials made with a compound and a standard engine by the Baltimore & Ohio R. R. throw light on the subject, and reveal facts which may escape attention.

In these trials, contracted exhaust nozzles were necessary in order to obtain high speeds with short cut-offs. The saving of steam with the compound engine above the common engine was 5.5 per cent., while the economy of fuel was 14.9 per cent., nearly three times that of the steam That there should be a greater economy in fuel than in steam is not surprising, because a locomotive boiler is, at best, over-worked, and if steam is saved to do a certain amount of work, a greater proportional economy in fuel must result; but it is hardly reasonable to assume that the economy of fuel should be three times greater than that of the steam, and we must look for the cause of this difference in some other direction. Both engines above referred to were duplicates in every respect excepting the cylinders, the coal used was the same for both, and the exhaust nozzles were of the same size, and therefore the cause of the greater economy of fuel in the compound engines cannot be attributed to the construction of the engines or to the coal used. But it should now be noticed that, although the exhaust nozzles were duplicates, they worked under different conditions; the standard engine discharged the steam at a higher release pressure than the compound, hence the standard engine had a stronger draught than the compound. The result of the difference in the blast is that, in the standard engine, the fire was broken up to a greater extent, and caused a large amount of loss in the small unburnt pieces of coal which were drawn out of the fire-box. Here then we find a good cause for some of the extra saving of fuel in the compound engine; and we may sum up the whole matter by saying that part of the saving of fuel in the compound engine was due to a milder exhaust. Just how much of the saving of fuel is due to the milder exhaust of the compound engine is difficult to determine, but the fact remains that the intensity of the exhaust does affect the amount of fuel consumed. This principle applies to the ordinary locomotive. When the maximum power is not required, means should be provided for changing the intensity of the exhaust, and any device by which this result can be obtained with ease and certainty at all times will be an improvement in the right direction.

Buffalo Hot Blast Steam Heating Apparatus.

The Buffalo hot blast steam heating apparatus, of which we give illustrations, will undoubtedly be appreciated by those who are interested in, and recognize the necessity of a good system for heating and ventilating factories and manufacturing establishments.

In this system the entire quantity of radiating surface is massed together into manifold sections, as shown in Figs. 1 and 2. These sections differ in size and number, according to the number of cubic feet of air to be heated. The whole heating surface—which consists of steel tubing—is encased in a steel jacket. Fresh air is taken directly from the outside of the building through a duct, and is either forced or exhausted over the steam pipe; from thence it passes through conveying air pipes or ducts to different portions of the building. This distribution of air is claimed to be complete and entirely independent of all other conditions, so that a uniform temperature is secured in all parts of the building, both at floor and ceiling, without reference to outside temperature. A feature, to which the manufacturers of these patented heaters call special attention, is the complete control of the heating surface, either when using live or exhaust steam, or both. This is secured by a patented valve placed between each section, as shown in Figs. 2 and 3. The cages in which the valves are fitted are made suitable for the different sizes of manifolds, and are fitted to receive a brass nut into which the valve stem screws. The general form of the valve is shown in Fig. 4; it is designed with a view of preventing any possibility for it to stick, leak, or become obstructed so as to impair its usefulness, and is made of such metal as to prevent corrosion or rusting. The only packing used in its construction is that in the stuffing-box around the valve stem. It is said that these valves do not leak when either live or exhaust steam alone, or both, are used. With this arrangement one or more sections can be run, as may be required.

It is claimed that, by concentrating the steam pipe, as is done in this system, a greater duty is secured for any stated number of feet of pipe, and it is said that actual experiments have shown that one-fifth of the amount of lineal feet of one-inch pipe required to heat a given number of cubic feet of air by direct radiation, will give equally as much heat when arranged in the form of a hot blast heater and distributed by a fan; or, in other words, 1,000 lineal feet of one-inch pipe in a hot blast box will give generally the result of 5,000 lineal feet of one-inch pipe strung around the building.

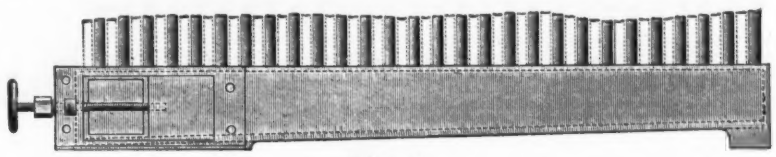


Fig. 4.

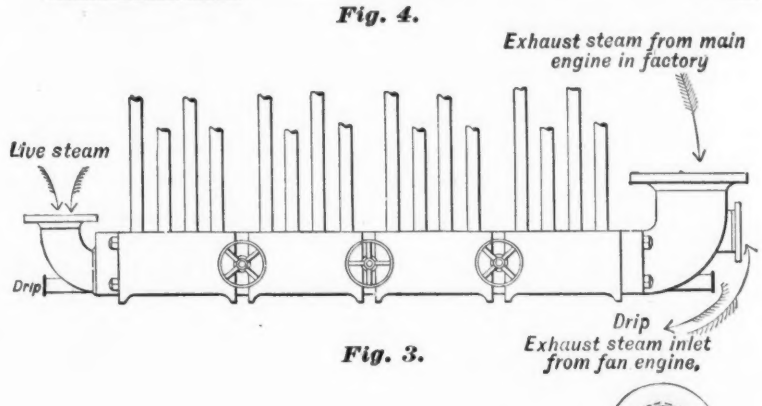


Fig. 3.

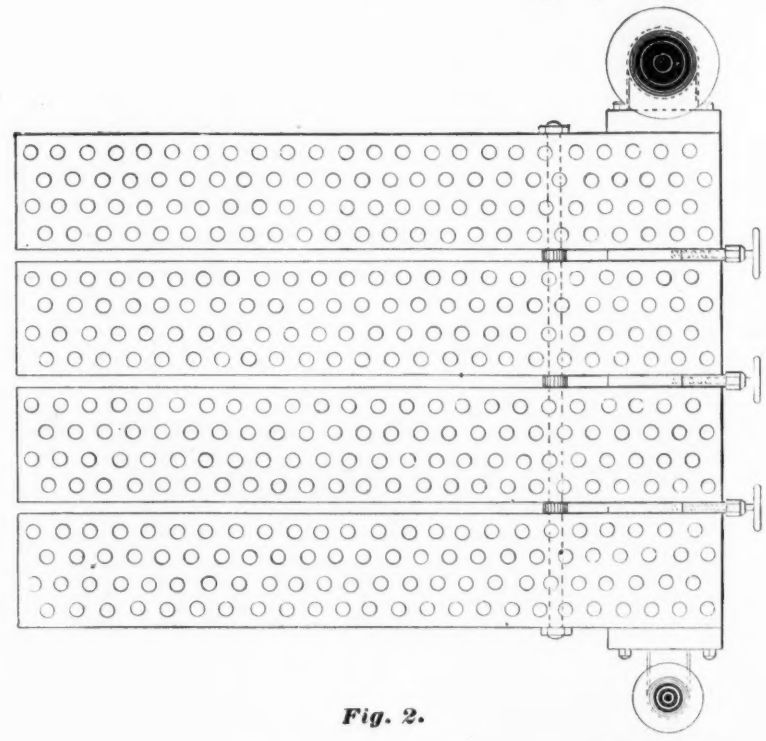
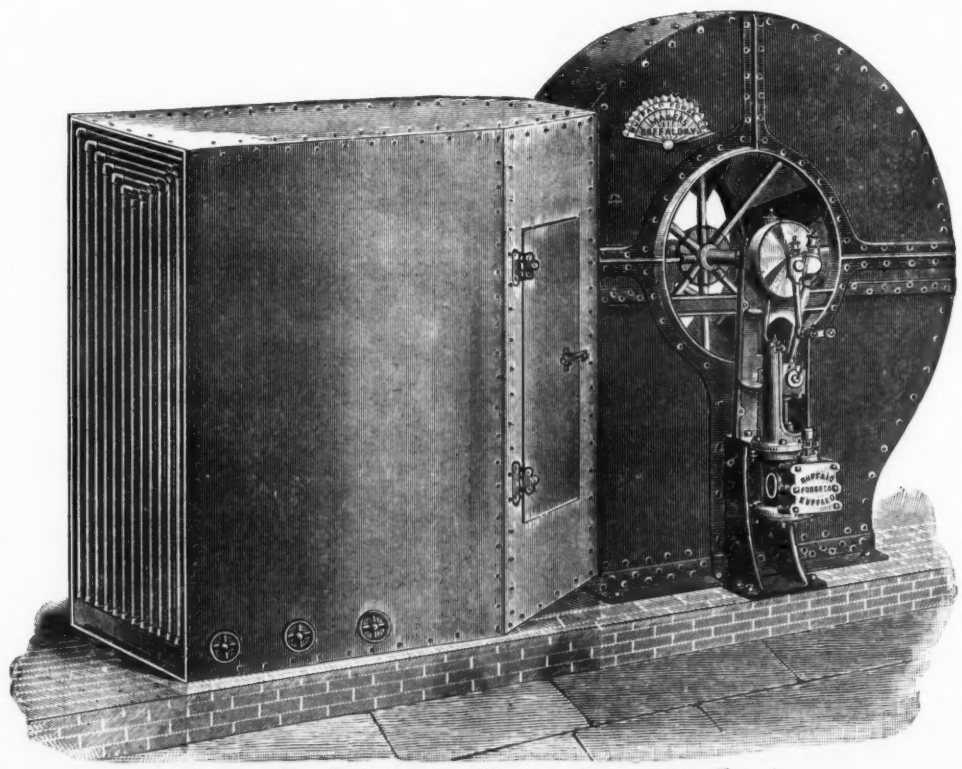


Fig. 2.



Buffalo Hot Blast Steam Heating Apparatus.—Fig. 1.

In summer, when the steam is turned off and the fan is kept running as usual, the apparatus will maintain a constant circulation of fresh cool air throughout the building, and again promote the comfort of the occupants.

With this system of heating, damage resulting from leakage in different parts of the building is avoided; and comparatively, the labor, care and expense in keeping the apparatus in order practically amount to nothing; the building can easily be kept at a constant temperature throughout; and no risks of fires are incurred. This system of heating buildings is furnished by the Buffalo Forge Co., Buffalo, N. Y.

Shipbuilding in Spain.

At Bilbao, Spain, a cruiser was recently launched, with royal honors, for the Spanish navy. This is the first cruiser built by private contract in Spain. In regard to the Spanish navy, and the encouragement of national industries, *Industries* says:

The navy of Spain had been allowed to degenerate into a most deplorable condition, very few of the vessels being fit for active service, and none of them up to the requirements of the present day. Urged by all parties, the government three years ago induced parliament to vote an extraordinary credit of £10,000,000 sterling for the construction of ships. With a view, however, to the encouragement of the national industries, it was stipulated that they were to be built in the country, that not more than 25 per cent. of foreign labor was to be employed, that the materials for the hulls and engines were to be obtained in Spain, and it was even stipulated that none of the auxiliary machinery was to be imported. Three twin-screw belted cruisers were allotted to Messrs. Martinez Rivas & Palmer, and at once steps were taken for putting the works in a position for completing the contracts within the time specified; for, in addition to the conditions above mentioned, it was stipulated that the first ship was to be completed, under very heavy penalties, in two years from the time the contract was signed. The large practical experience of Sir Charles M. Palmer, Bart., M. P., and the extensive resources of Señor Don Jose M. Martinez de las Rivas, aided by a competent staff, has overcome all the difficulties incidental to the position, and the first ship has been launched in thirteen months after the signing of the contract.

The firm has erected most complete engineering works, with all the latest appliances, which have been designed for the most part by Mr. McKechnie, who is well known on the Clyde, and who has imported the chief members of his staff and his most important tools from Glasgow. The shipbuilding department is also under the charge of another Clyde man, Mr. J. P. Wilson, while the steel work is managed by Mr. A. Tilley, late of the Barrow Hematite Steel Company, and both these establishments are thoroughly well equipped and capable of a large turnout. A dry dock, having a length of 470 feet, a breadth of 73 feet, and a depth of 23 feet, is nearly completed, under the superintendence of Mr. John Thomson, C. E., Newcastle. In order to make the establishment quite self-contained, very large ordnance works have been started for the manufacture of guns of all kinds. This is under the management of Colonel Albarran, a distinguished artillery officer in the Spanish Marine Artillery Corps.

In addition to the works of Messrs. Martinez Rivas & Palmer, at Bilbao, there are two other places in Spain employed on government work, namely, La Magninista Terrestre Maritima, at Barcelona, which is at present constructing engines for several war ships, and the other, Messrs. Portilla, White & Co., of Seville, who are engaged in the manufacture of guns and mountings. No doubt the success of these works will lead to others being started, for as yet the Spaniards are very cautious in their industrial enterprises. Few care to go in for investments the interest of which is not guaranteed by government. At present the deposits in the Bank of Spain have accumulated to a very large amount, simply because there is a want of spirit in industrial enterprises. If these could be guided by British experience, as in the case of Bilbao, great developments might be expected.

The government of Germany has posted notices in some of its arsenals that women will no longer be employed at night work.

The London *Times* has a quite extended account of a new condenser for converting salt water into fresh water at sea. It states, which is very true, that the use of any very material quantity of salt water, introduced into a boiler, will, as boilers are now made, incrust it dangerously, and that various condensers have been made for the purpose of affording a supplementary supply of fresh water. These, it concludes, are not serviceable, because the salt is retained as scale in the condenser, and soon ruins it. In the new condenser this is prevented by rapid circulation and by other means, so that there is practically no deposit in the condenser. But just where the salt goes to it fails to say. If it goes into the boiler, where it is not wanted, it would be just as well to pump the salt water direct to the boiler.

The uncertainty of a truck getting through the streets of New York in any certain—or reasonable—time, is bad for the retail business of the city. A dealer may send a truck out with a sheet of iron, or a couple of bars of steel, in response to a telegram from some out-of-town customer; he may send it out in the morning with no certainty as to whether he will see it again before night. So far as truck traffic is concerned, the business streets of New York are congested, to use a medical term. And the worst of it is, the remedy is not apparent. Unless the what may be called business streets of New York can be extended, the retail business must largely go elsewhere.

The electric light companies in New York complain that they are charged exorbitant rates for the privilege of putting their wires in the subways. Their wires ought to go there, but they have a right to protest against extortion, if it is really exacted. The companies do not receive as much sympathy as they would had they shown a willingness to comply with the demand that their wires should go underground.

Machinists' Supplies and Iron.

NEW YORK, Sept. 27, 1890.

Iron—American Pig—The demand has been fully maintained, and the market has been fairly active, otherwise no new features have occurred. The present volume of consumption is said to be the largest in the history of the country, but increasing production is becoming more manifest, and the offerings point to an accumulation of supplies, as well as to more anxiety to sell, which imparts an easier feeling.

We quote standard Northern brands, $17 to $18 for No. 1 Foundry, and only in regard to special brands are these prices exceeded; No. 2 is selling at $16 to $16.50. Southern brands of good quality, $16.75 to $17 for No. 1 Foundry, and $15.75 to $16 for No. 2.

Scotch Pig—Moderate inquiries are reported, and the supplies are firmly held.

We quote Coltness, $24 to $24.50; Dalmellington, $21.50 to $22; and Eglington, $19.50 to $20.

Bar Iron—A better demand has been noticed, with firmer feeling, but prices are without quotable change.

We quote Common, $1.85; Medium, $1.90; Refined, $1.95 to $2 for round lots on dock.

Plates—A better demand has been reported, but without quotable change.

We quote Common Tank, $2.25 to $2.30; Refined, $2.35 to $2.45; Shell, $2.35 to $2.45; Flange, $3.40 to $3.45; Extra Flange, $3.60 to $3.75.

Lead—Advances in prices, both here and in the West, have been made, on account of the scarcity of supplies. Sales have been made at 5.07½c. to 5.10c. for prompt and near delivery, while holders ask 5.10c. to 5.15c.; sales in the West have been made at equal to 5.17c. laid down here. The demand has been moderate, and consumers are buying in a conservative way, but over 500 tons have changed hands.

Spelter—There has been a moderate demand for Western, with light offerings, and prices ruling steady.

We quote ordinary brands of Western, 5.55c. to 5.60c.; choice, 5.70c. to 5.75c.; refined, 6¾c. to 7c.; Silesian, 7⅜c. to 7½c.

Tin—There has been moderate trading; 24 70c. was bid for spot and September, with sellers at 25½c.

Antimony—The market for Regulus has ruled strong, with a moderate jobbing demand.

We quote Hallett's, 19⅞c. to 20c.; L. X., 20¾c.; and Cookson's, 22c.

Copper—The market has ruled steady, but without displaying any new features. Common casting brands are quoted at 14½c., and Arizona, 15⅝c. to 15¾c.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted Immediately—A foreman blacksmith. Address E. J. Codd Co., Baltimore, Md.

Wanted—Position by machinist while attending Cooper Union. Address C. A. W., AM. MACHINIST.

Pattern maker wants position while attending Cooper Union. Address W. F. W., AM. MACHINIST.

Experienced iron foundry and mach. bookkeeper desires situation. B., 614 Court street, Brooklyn.

Wanted—Experienced draftsman, with large company in Pennsylvania, building engines and rolling-mill machinery. Box 72, AM. MACHINIST.

Boiler Makers Wanted—Steady work at good wages to good, steady men. Merrill-Stevens Engineering Co., Jacksonville, Fla.

Wanted—Six practical experienced iron moulders. For further information address Haxtun Steam Heater Co., Kewanee, Ill.

An experienced draftsman, with technical education, wants employment in or west of Ohio. Box 81, AMERICAN MACHINIST.

Wanted—Situation as foreman, by machinist and draftsman; technical graduate; eight years' experience. Address Box 82, AMERICAN MACHINIST.

Wanted—By a prac. tool maker, position to take charge of milling mach. dept., where close, interchangeable work is required; refs. G. W. E., AM. MACH.

Designing, drafting wanted to do at home; exp'd in engines, boilers, pumps, hydraulic machinery, machine tools, roofs, bridges and gen'l machinery; terms reasonable. Expert, 842 Union st., W. Phila.

Machinists Wanted—First-class floor hands and fitters of large experience and of good habits can find steady employment and liberal wages. Address Morgan Engineering Company, Alliance, O.

Wanted—Two good metal pattern makers, on iron pipe fittings and brass valves. Address, stating wages and experience, The Kelly & Jones Co., Greensburg, Pa.

Wanted—Situation by tool maker understanding the designing and construction of small machines and tools, capable of taking charge of and turning out work cheap. Box 77, AMERICAN MACHINIST.

Wanted—A first-class draftsman and mechanical engineer as superintendent of foundry, machine and boiler works. Address with reference, stating salary expected, Boilers, AMERICAN MACHINIST.

A mechanical engineer of 20 years exp. with all kinds of machinery desires an engagement. Can take full charge of work, designing, planning, etc. Best of references. A. M. E., AMERICAN MACHINIST.

Wanted—Traveling salesman for engines. One who has an extensive trade and acquaintance. Don't apply unless thoroughly competent. Address, with salary, Weston Engine Co., Painted Post, N. Y.

Wanted—Any kind of a respectable business position, with good chance of promotion, by college educated young woman. One who has had little business exp., but who possesses an average brain, and is willing to work. Address B, AM. MACHINIST.

Wanted—A competent man who thoroughly understands making forging dies; two first-class machinists thoroughly competent to make punch dies, milling-machine cutters and fixtures. Steady work for good men. Address Syracuse Forging and Gun Co., Batavia, N. Y.

Superintendent—A member of the A. S. M. E. now in charge of an iron works employing 500 hands, desires to make a change before the end of the present year. Specialty, fine interchangeable machine and tool work, together with good designs and systematic shop management and accounts. Address Box 80, AMERICAN MACHINIST.

Wanted—A few good, industrious and sober machinists and molders on mining and saw-mill machinery and engines; permanent places and highest pay; married men with families preferred; beautiful and healthy location; good homes and schools; rapidly growing city. North Star Iron Works, Parish Mfg. Co., Ashland, Wis.

Wanted—Superintendent capable of taking charge of a long-established machine shop, boiler shop, and foundry. Must thoroughly understand each department, especially up in modern engine building, able to figure cost of production, energetic, and able to produce results. An experienced man who now occupies such a position and desires a change, preferred. Address, with salary, Superintendent, AMERICAN MACHINIST.

Wanted—Two copper plate engravers; one expert in lettering and stipple or sand tinting as shown on coast and geodetic survey charts; salary $1,800 per annum; and one with less experience; salary $900 per annum. Also expert engravers of topography and stipple or sand tinting, to contract for work to be done at their homes. Further information will be furnished on application. T. C. Mendenhall, Superintendent, U. S. Coast and Geodetic Survey, Washington, D. C.

Wanted—Position as superintendent, designer or draftsman. Designer of over twenty-five machine tools in last four years, that are selling faster than they can be made; illustrated and advertised in AMERICAN MACHINIST. If you wish to make a line of engine lathes, planers, shapers, milling machines, drills, or other tools; if you want some one to look after or improve what you have; if you are starting a company and want some one to design or superintend, address Box 83, AMERICAN MACHINIST.

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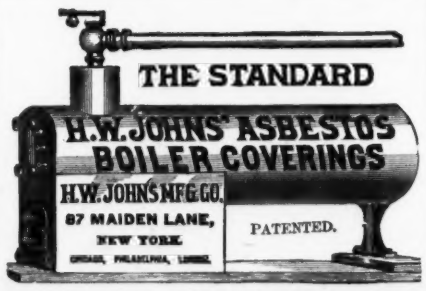

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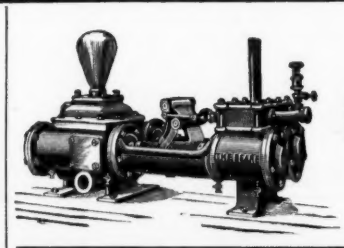

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foreign brands of steel should not forget that while they have been perfecting their own tools we have not been standing still. Our Tool and Die Steel is second to none.

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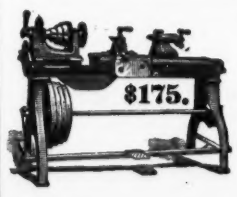

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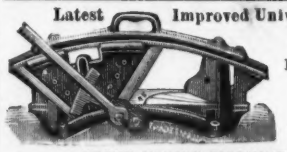

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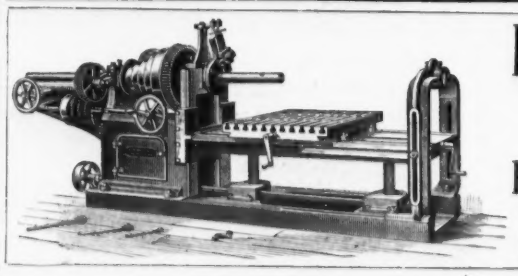

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Advertisements will be inserted under this head at 35 cents per line, each insertion.

Cheap 2d-hd lathes & planers. S M York, Clev'd, O.

Koopman's Scales for quick measurements.

Just out; aluminum-steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, Ohio.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

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Complete list of our Scales and other new tools for 2c. stamp. A. T. Koopman, Chicago.

For Sale—Cheap, one 1½-inch Schlenker Bolt Cutter. Address Capitol Mfg. Co., Chicago, Ill.

For Sale—One gear molding machine (new). Stilwell & Bierce Mfg. Co., Dayton, Ohio.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

For Sale—At a bargain, 12-inch pipe-cutting machine, with expanding dies. Address X. Y. Z., 245 South Third street, Philadelphia.

Wanted—To form a company to build machine tools, by party with shop and machinery. Address BOX 79, AMERICAN MACHINIST.

Wanted—A drop hammer run hand, 400 pounds weight of hammer. The Fox Machine Co., Grand Rapids, Mich.

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For Sale—Two hank winders for jute yarns, made by J. & W. Lyall, New York; one hank winder made by Boyd & Co., Glasgow; all in good condition, and little used. Will be sold at reasonable figure. Apply to Pearson Cordage Co., Boston, Mass.

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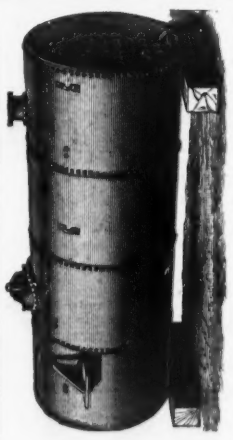

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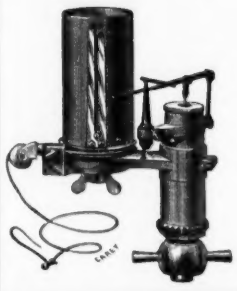

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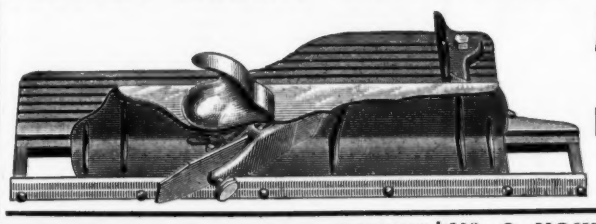

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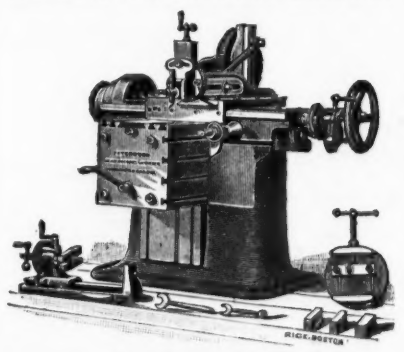

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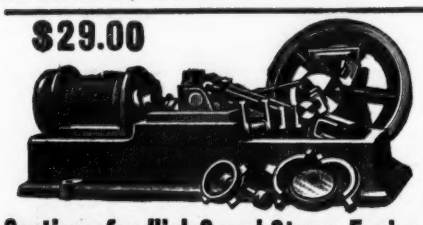

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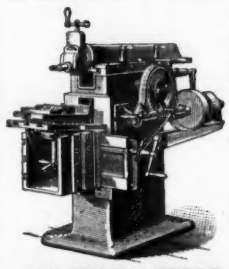

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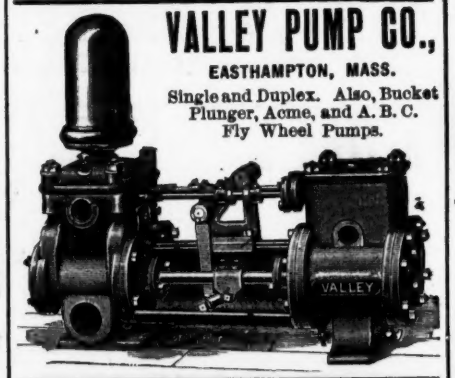

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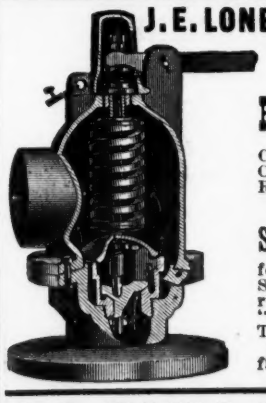

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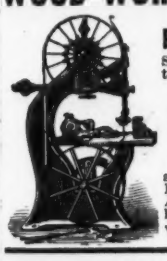

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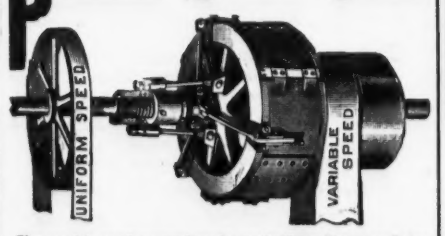

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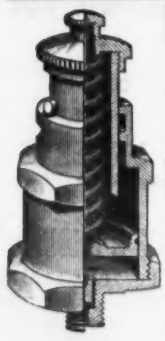

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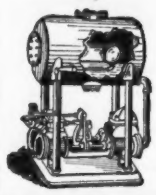

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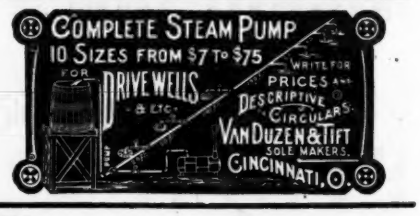

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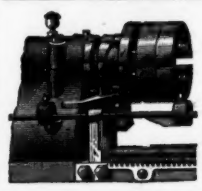

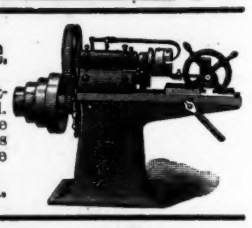

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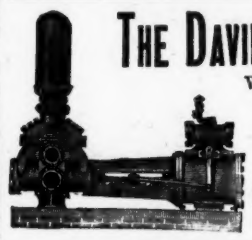

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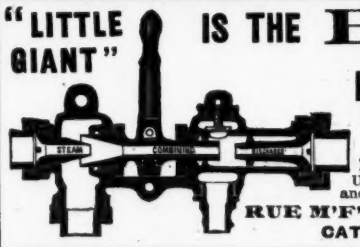

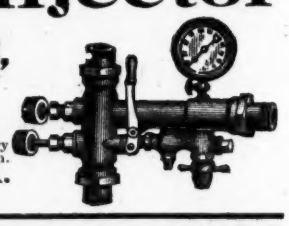

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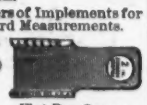

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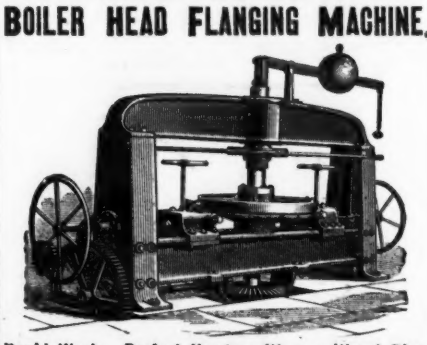

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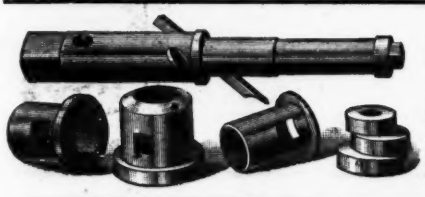

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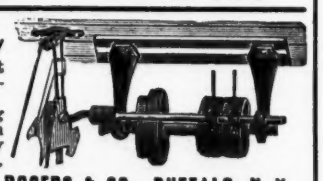

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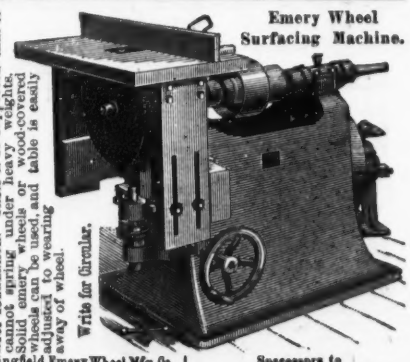

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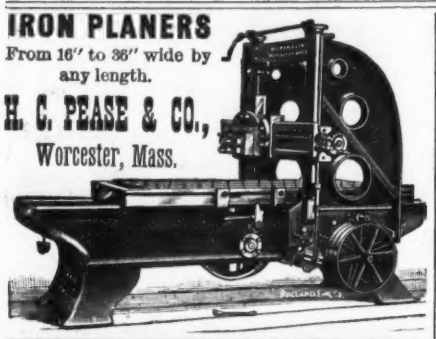

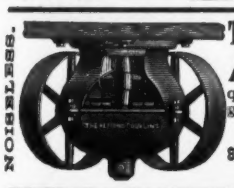

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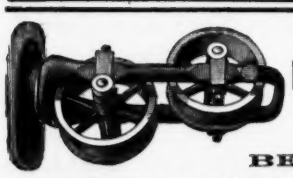

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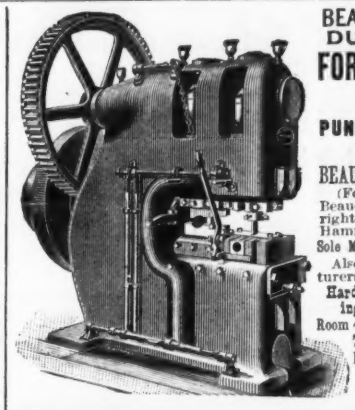

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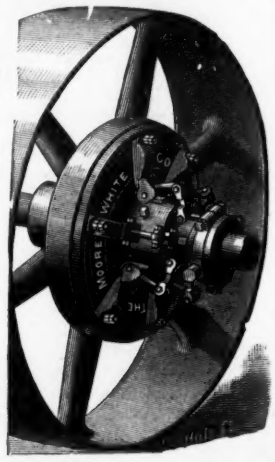

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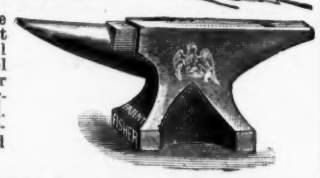

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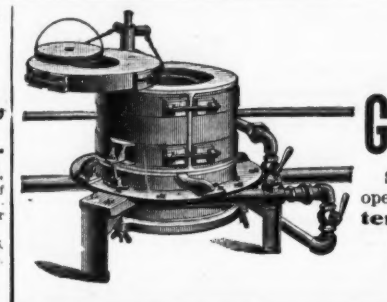

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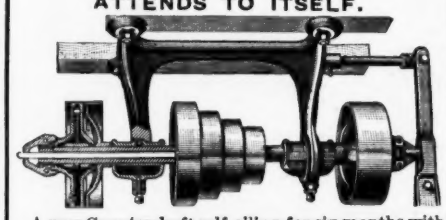

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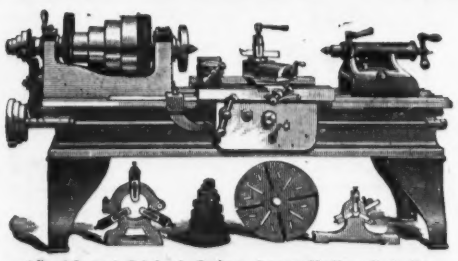

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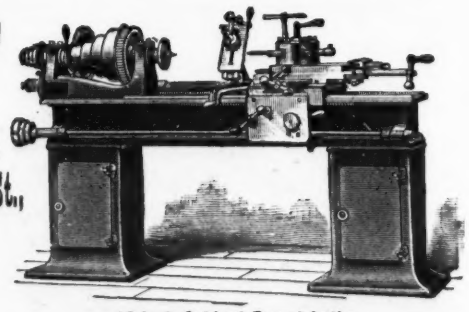

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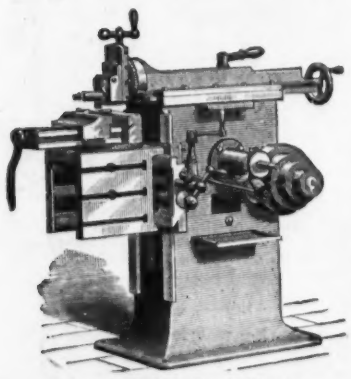

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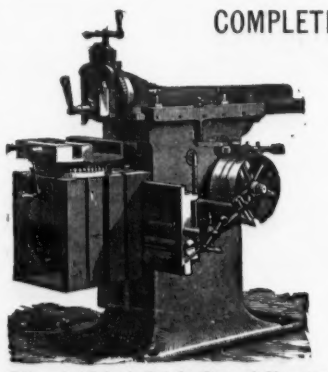

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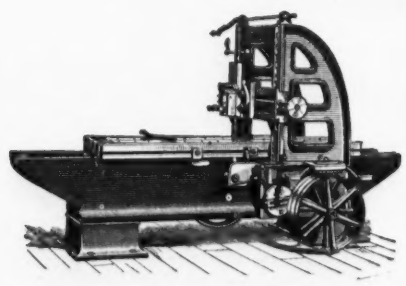

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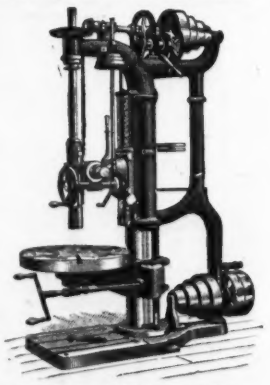

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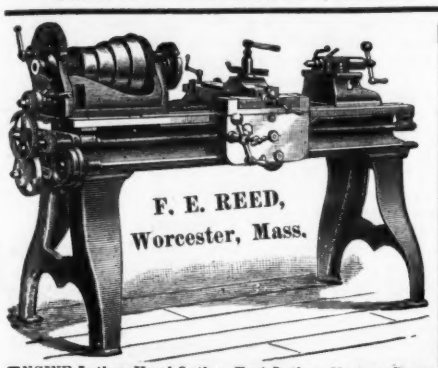

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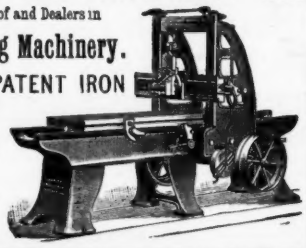

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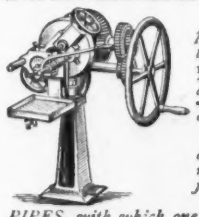

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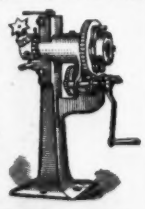

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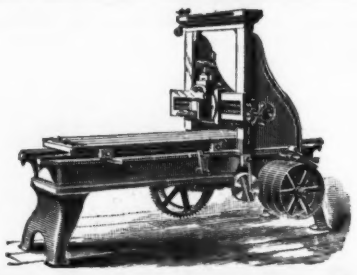

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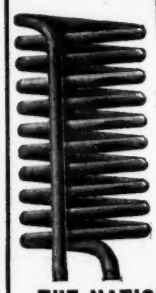

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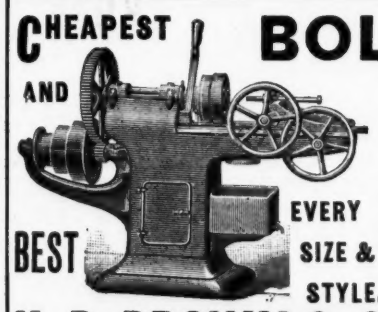

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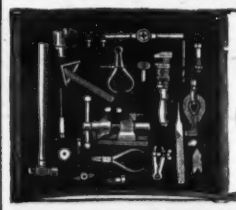

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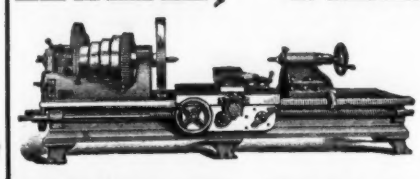

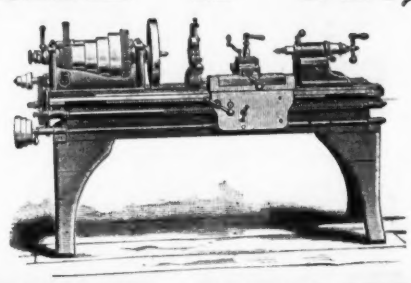

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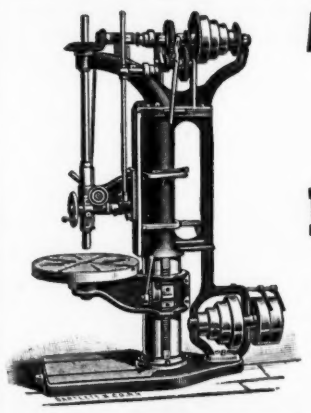

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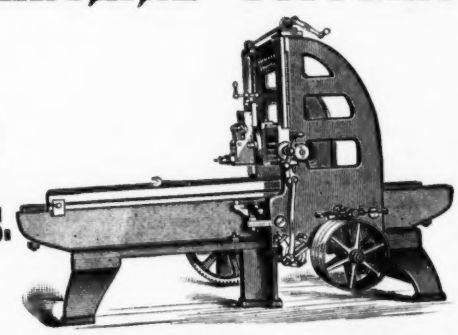

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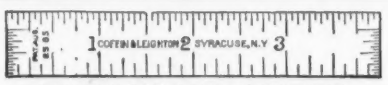

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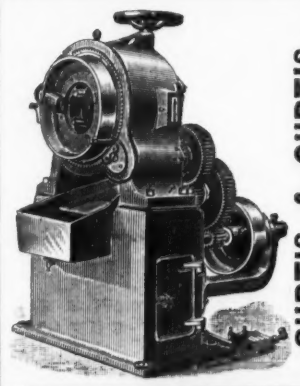

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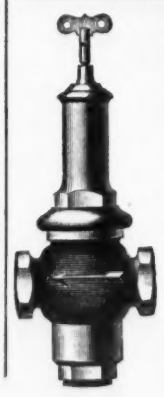

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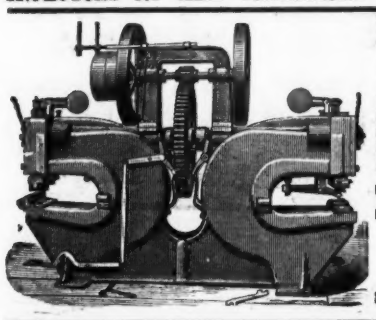

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Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam-Driven
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OVER 300 SIZES.
ALSO
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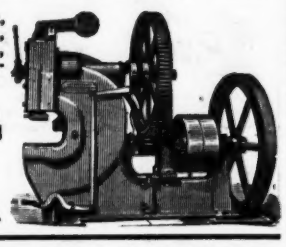
Send for New Catalogue.



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One 30 in.x25 in.x6 ft.
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Two 30 in.x25 in.x8 ft.
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ACME MACHINERY CO.
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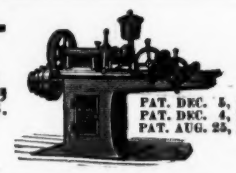
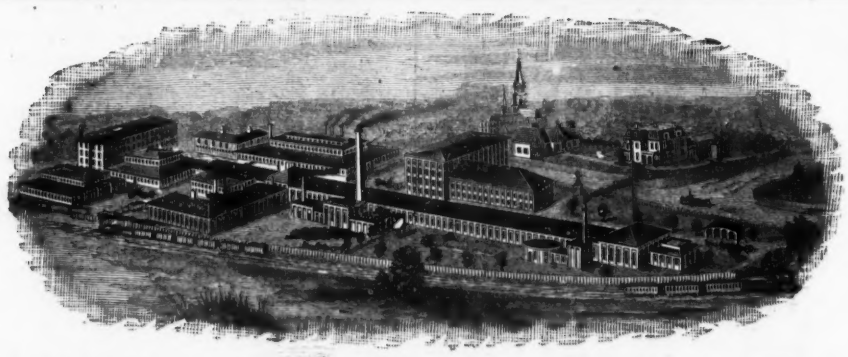
Also SEPARATE HEADS and DIES.
FIRST PREMIUM, CINCINNATI CENTENNIAL.





The Corliss Steam Engine Co.
PROVIDENCE, R.I.
Incorporated June, 1856; Established by
GEORGE H. CORLISS,
INVENTOR OF THE CELEBRATED
"CORLISS ENGINE."
DESIGNER & BUILDER OF THE FAMOUS
"CENTENNIAL ENGINE,"
Exhibited at the Philadelphia Exposition, 1876.

These works have been fully equipped, at great cost, with heavy special tools, of his invention, for the manufacture of this perfected engine, which is a guarantee of superiority in workmanship, and interchangeability of parts never before attempted in the line of steam machinery.

The public will understand that we have no relations with American or European builders of so-called "Improved Corliss Engines," and that the final and perfected Engines of Mr. George H. Corliss, embodying his latest ideas, is to be obtained, in America, exclusively at our works.

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CORLISS PATENT VERTICAL TUBULAR WATER LEG BOILER,

Especially adapted for compound and triple expansion engines requiring superheated steam and at very high pressure.

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METAL-WORKING MACHINE TOOLS
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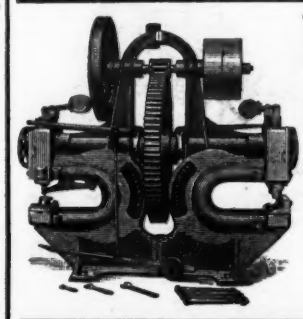

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PUNCHES AND SHEARS,
All Designs and Sizes,
AND A FULL LINE OF
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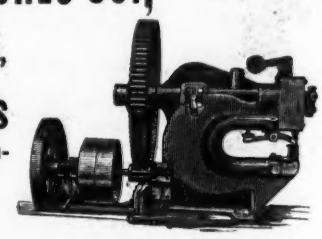
FOR
Boiler Makers, Bridge Builders, Ship Builders, Railroad Shops, Locomotive and Car Builders, etc., etc.



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FORGING AND WELDING BY PETROLEUM AIR BLAST.
ALL OIL BELOW BURNERS! NO SMOKE, DIRT OR ASHES!
Represented by WILLIAM PICKETT, SON & CO., 170 Lake St., Chicago. W. S. COLLINS, Temple Court, 7 Beekman Street, Rooms 814-816, New York. CHILON JONES, Gananoque, Can. G. M. SMITH, Los Angeles, Cal. C. S. BARROWS, 46 Wade Building, Cleveland, Ohio, Michigan and Indiana. GILBERT & BARKER MFG. CO., General Agents for the United States, Springfield, New York and Boston. THOMAS, SHEPARD & SEARING, Arapahoe Building, Denver, Col.
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July 5, 1887
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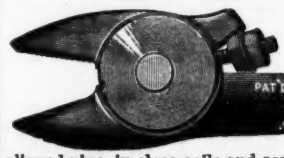
July 23, 1889
☞ We will replace in Stock or Mutual Companies any Insurance canceled on account of using this System, when installed according to our plans.



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Quick and handy in adjustment. Invaluable for work on clipped pipe, in close coils and corners that cannot be reached with other wrenches. Made entirely of drop forged steel. *Four sizes.*
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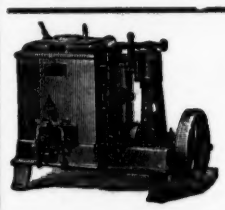

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Automatic Steam Engine. Kerosene Oil or Natural Gas Fuel
— SAFE, EFFICIENT, DESIRABLE. —
The Best Power for Farmers, Printers, Carpenters and Manufacturers.
Automatic in both fuel and water supply, requiring but little attention after once started.
1, 2, 4, 6 and 8 H. P. Single.
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DROP FORGINGS.

STEAM HEATING.
Barnard's Condensing System will accomplish the following desirable features:
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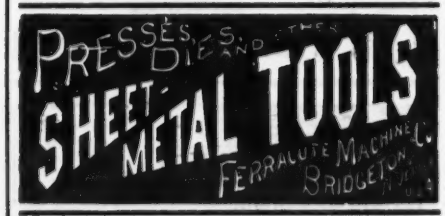
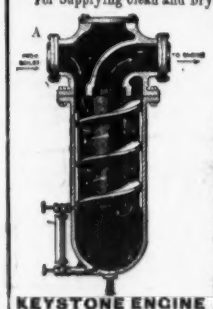


SIMPSON'S CENTRIFUGAL SEPARATOR,
For Supplying Clean and Dry Steam to Engines, Dry Houses, etc.



Simpson's Centrifugal Separator and Trap.
For Supplying Clean and Dry Steam to Engines, Dry Houses, etc.
Place Separator as close to engine as possible, the steam taking a spiral course between the threads causes the water to be thrown by centrifugal force against the outer walls, while the dry steam goes through the small holes to center of pipe. Steam can enter at A or top, as convenience may require; also used in conveying steam long distances; for Steam Hammers and Dry Houses, Water Gas Generators, and for all purposes where Dry Steam is necessary.
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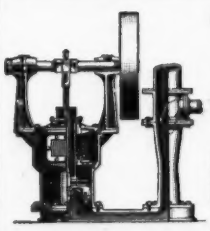

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CONSULTING AND MECHANICAL ENGINEERS
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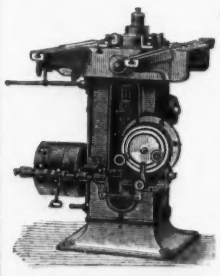
No Air Locks. 15 to 50 per cent. fuel saved or equal amount of power gained. Runs with same economy as engine.
Adapted to all kinds of Engines. *Send for Circular.*



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PORTABLE AND STATIONARY.
RACK-CUTTING AND KEY-MAKING ATTACHMENTS.
Giant Key-Seater Co.,
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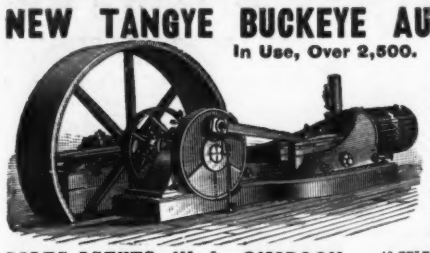
In Use, Over 2,500. 25 to 1,000 H. P.



These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-contained Automatic Cut-off Engines 12 to 100 H. P. for Driving Dynamo Machines *a specialty*. Illustrated Circulars, with various data as to practical Steam Engine Construction and performance, free by mail. **Address, BUCKEYE ENGINE CO., Salem, Ohio.**

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Bucket.

Automatically drain the water of condensation from **HEATING COILS** and return it to the boilers whether the coils are **above** or **below** the water level in boiler, doing away with pumps and other mechanical devices for such purposes.

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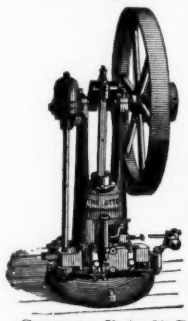

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Consume 25 to 75 Per Cent. Less Gas than ANY other Gas Engine doing the same work.

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We have in stock, that we could ship within a few days from receipt of order, as follows:

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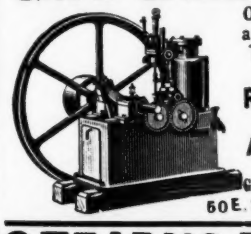

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NEW AND SECOND HAND.

IN STOCK.

Engine Lathe,	11x6 ft.	Reed,	good order.
" "	12x5 ft.	Young,	new
" "	14x4 1-2 ft.	Putnam, no screw,	cheap
" "	14x6 ft.	Hendey, heavy pattern,	new.
" "	14x6 ft.	do taper attachment,	"
" "	14x6 ft.	Prentice, Comp. Rest,	"
" "	14x6 ft.	do. R. F. Rest,	"
" "	14x6 ft.	Fitchburg, new pattern,	"
" "	14x6 ft.	do Taper Attachment,	"
" "	15x6-8 ft.	Porter,	"
" "	16x6-8 ft.	Wrights,	"
" "	16x6 8 ft.	Fitchburg, new pattern,	"
" "	16x6-8 ft.	Prentice, Comp. Rest,	"
" "	16x8 ft.	McMahon, heavy,	"
" "	16x6-8 ft.	New Haven,	fair order.
" "	16x8 ft.	Fitchburg,	good order.
" "	18x6-8 ft.	New Haven,	cheap.
" "	18x9 ft.	Hewes & Phillips,	"
" "	18x8 ft.	Prentice, Comp. Rest,	new.
" "	18x8 ft.	Fitchburg, new pattern,	"
" "	18x8 ft.	Wright,	"
" "	18x8-10 ft.	Hendey, heavy,	"
" "	20x8 ft.	Wood Light,	good order.
" "	20x12 ft.	McMahon,	new.
" "	20x12 ft.	Wright,	"
" "	20x22 ft.	Wright,	A-1 order.
" "	20x10 ft.	Lathe & Morse,	new.
" "	24x12 ft.	Wright,	"
" "	25x10 ft.	New Haven,	cheap.
" "	27x12 ft.	Lathe & Morse,	new.
" "	27x14 ft.	Fitchburg, new pattern,	"
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" "	36x18 ft.	Putnam,	good order.
" "	72x20 ft.	Old Style,	cheap.
Planers,	24x6 ft., 26x8 ft., 30x8 ft., 32x12 ft., 43x18 ft.		2d hand.
"	22x5 ft., 24x6 ft., 25x8 ft., 30x10 ft.		new.
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Shapers,	15, 16, 24, 30 in. stroke,		"
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Garvin No. 2 Universal Milling machine,			new.
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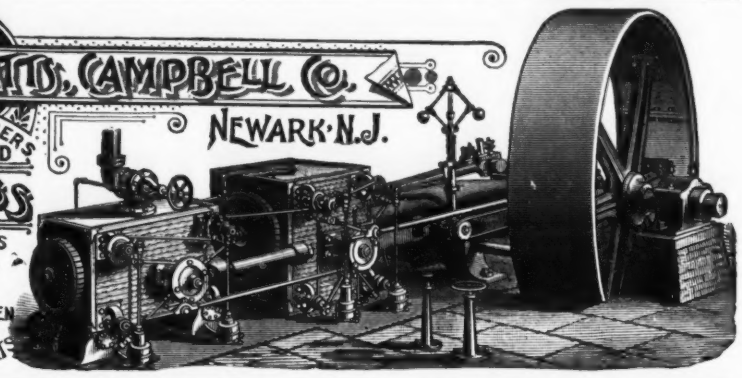

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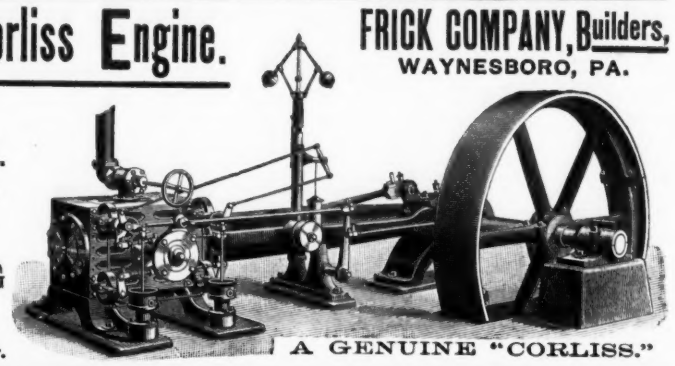

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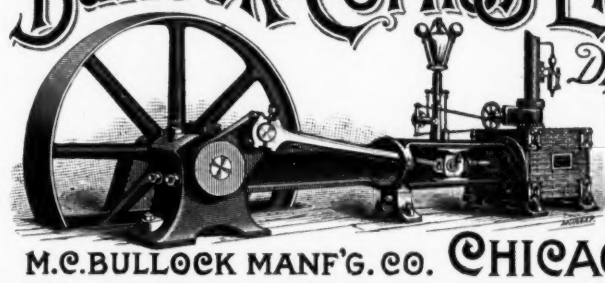

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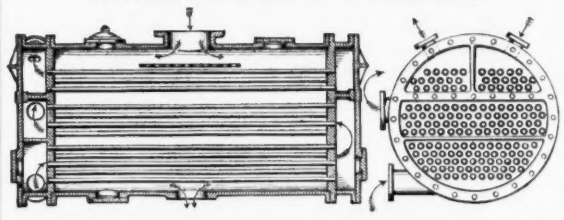

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Lighthall Surface Condensers with Cobb's Improvements. Light Weight Brass Condensers a Specialty. Also Feed Water Heaters, Tube Heads, Screw Glands, Packings, &c.

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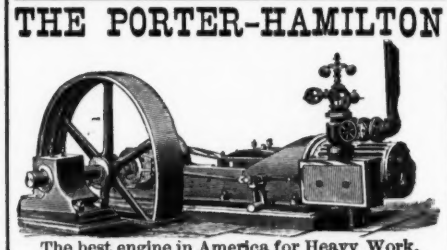

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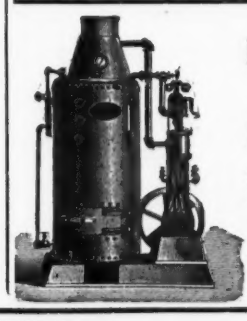

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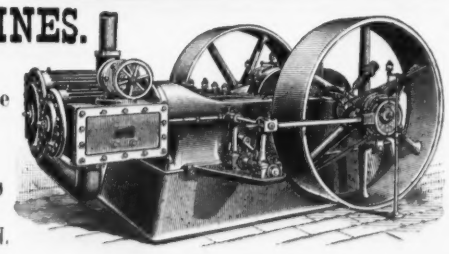

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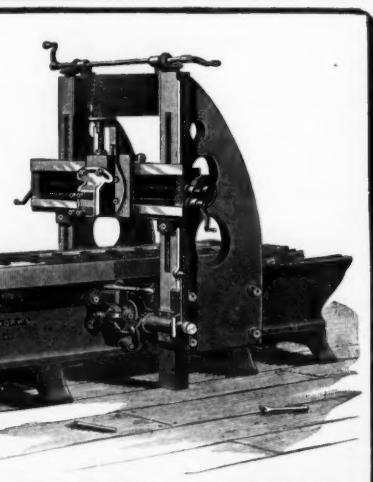

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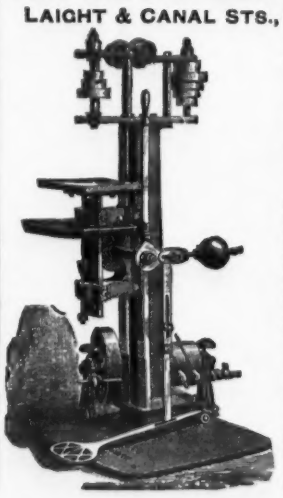

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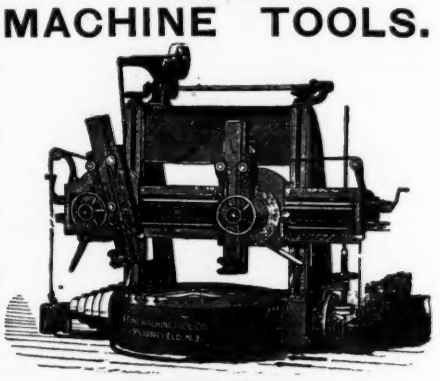

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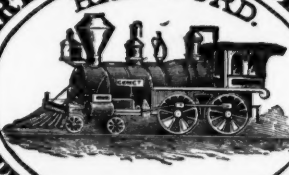

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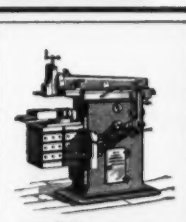

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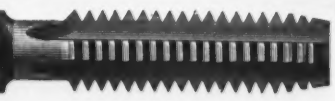

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